

APPENDIX M

**Draft Fish & Wildlife Coordination  
Act Report for the San Luis Drainage  
Feature Re-Evaluation**

---





# United States Department of the Interior

FISH AND WILDLIFE SERVICE  
Sacramento Fish and Wildlife Office  
2800 Cottage Way, Room W-2605  
Sacramento, California 95825-1846

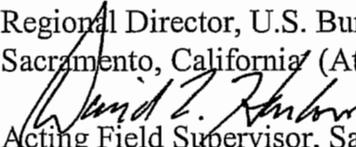


In reply refer to:  
San Luis Drainage Feature Re-Evaluation

FEB 7 2005

## Memorandum

**To:** Regional Director, U.S. Bureau of Reclamation,  
Sacramento, California (Attn: Gerry Robbins)

**From:**   
Acting Field Supervisor, Sacramento Fish and Wildlife Office,  
Sacramento, California

**Subject:** Draft Fish and Wildlife Coordination Act Report for the San Luis Drainage  
Feature Re-Evaluation

This memorandum transmits the Fish and Wildlife Service's (Service) Draft Fish and Wildlife Coordination Act Report for the San Luis Drainage Feature Re-Evaluation Project. This Report is prepared under the authority of, and in accordance with, the provisions of section 2(b) of the Fish and Wildlife Coordination Act (48 stat. 401, as amended: 16 U.S. C. 661 et seq.). The draft report assesses potential project effects on fish and wildlife resources and provides our recommendations to avoid, minimize or compensate potential adverse effects and is based on the Service's review of the 2004 *Plan Formulation Report Addendum* and the *Administrative Draft Environmental Impact Statement for the San Luis Drainage Feature Re-Evaluation Project* in western Fresno County, California. This report has been submitted to the California Department of Fish and Game and National Oceanic and Atmospheric Administration National Marine Fisheries Service for review and comment. The project's effects on federally listed species, pursuant to section 7 of the Endangered Species Act of 1973, as amended, are being addressed separately.

If you have any questions regarding this report, please contact Mark Littlefield at (916) 414-6581.

Attachment

cc:  
AES, Portland, Oregon  
Bill Loudermilk, CDFG, Fresno, California  
Brian Kinnear, NOAA Fisheries, Sacramento, California

TAKE PRIDE  
IN AMERICA 



United States Department of the Interior  
U. S. Fish and Wildlife Service

Draft Fish and Wildlife Coordination Act Report

San Luis Drainage Feature Re-Evaluation Project



Sacramento Fish and Wildlife Office  
Sacramento, California

February 2005



## EXECUTIVE SUMMARY

This is the U.S. Fish and Wildlife Service's (Service) draft report on the effects of the U.S. Bureau of Reclamation's (Reclamation) proposed Central Valley Project's (CVP) San Luis Drainage Re-Evaluation Project (SLDFR) on fish and wildlife resources. It addresses the impacts of the proposed project on fish and wildlife resources in the San Joaquin Valley, specifically within the Westlands Water District (Westlands), the Northerly San Luis Unit Area, San Joaquin River Basin, and the Sacramento/San Joaquin River Delta (Delta). This report has been prepared under the authority of, and in accordance with, the provisions of the Fish and Wildlife Coordination Act (FWCA) (48 stat. 401, as amended; 16 U.S.C. 661 et. seq.). The FWCA requires Federal water resource development or licensing agencies to consult with the Service and to give equal consideration to the preservation, conservation, and enhancement of fish and wildlife resources with other project purposes.

Our analysis is based in part on engineering, hydrological, biological, and environmental contaminant related information provided by Reclamation prior to December 2004, including: Reclamation's San Luis Drainage Feature Re-Evaluation administrative draft Environmental Impact Statement (ADEIS), dated September 2004; Plan Formulation Report (PFR), dated December 2002, and Plan Formulation Report Addendum, dated July 2004; Draft Alternatives Report, dated October 4, 2002; Preliminary Alternatives Report, dated December 2001; Draft Work Plan dated October 2001 for the San Luis Drainage Feature Re-Evaluation and Environmental Impact Statement (Draft Work Plan); the Functional Analysis Study Workshop Report, dated August 2001; Interagency Scoping Workshop documents; the San Luis Act; Court of Appeals findings (Case Number 95-15300); and the Draft White Paper-Mitigation Requirements Related to Evaporation Ponds in the San Joaquin, dated July 2002 .

Our evaluation of effects to natural resources are based on literature reviews, field reconnaissance, personal communications, and an analysis of resource information provided by Reclamation through various contractors (URS, Applied Bioscience, and Hydro Focus). Based on data provided by Reclamation, the expected construction period for the proposed project has been estimated to be from 5 to 20 years, with a project life of 50 years, resulting in a 50+ year period of analysis. Construction is expected to start in 2006 and to be completed by 2026.

Reclamation has not yet developed identified locations for specific project features, nor have they developed a mitigation plan to compensate for natural resource losses. As a result, at this time the Service is unable to completely identify with- and without-project scenarios, project related impacts, or to fully evaluate the adequacy of mitigation proposed by Reclamation. In an effort to provide Reclamation with guidance and direction, the Service is providing in this report, a mitigation strategy and recommendations. The strategy and recommendations, if implemented as part of the proposed action, would address many of the Service's concerns regarding potential, residual, or unavoidable impacts to fish and wildlife resources.

This FWCA report: 1) evaluates the impacts of in-valley disposal and three drainage impaired agricultural land retirement alternatives as described in the ADEIS; 2) recommends methods for mitigating losses to affected natural resources; and 3) encourages the comprehensive management of biological resources within Westlands and any lands retired by this action.

This report does not specifically focus on impacts to federally listed threatened or endangered species. Impacts to federally listed species associated with this project will be addressed separately in formal procedures pursuant to section 7 of the Endangered Species Act of 1973, as amended (ESA). The final FWCA report will incorporate the section 7 consultations for this project.

The Service recommends that Reclamation:

- Provide further evaluation of the proposed action and alternatives to assist in avoiding and/or minimizing fish and wildlife impacts associated with construction and operation of evaporation ponds, most notably to migratory birds as defined and protected under the Migratory Bird Treaty Act.
- Include and evaluate a *full* land retirement alternative (Service's Preferred Land Retirement Alternative) on all drainage impaired lands in the San Luis Unit, maximizing elimination of drainage at its source and avoidance of adverse fish and wildlife effects.
- Fully support efforts of the Mitigation Working Group so that mitigation requirements for In-Valley Alternatives include and evaluate: 1) associated revised mitigation protocols; 2) risks associated with reuse facilities and possible mitigation measures; and 3) specific management plans, including a detailed cost estimation and framing of the Adaptive Monitoring and Management Plans mentioned in the ADEIS.
- Include participation of the California Department of Fish and Game and California Department of Water Resources in the Mitigation Working Group.
- Fully consider and include mandates and directives as provided under the Central Valley Project Improvement Act, the CALFED Bay Delta Program, the ESA, the Clean Water Act, and the Migratory Bird Treaty Act.
- Include a full range of water demand and supply management options, including irrigation efficiency and land retirement and fallowing.
- Provide a more detailed assessment of land management options to maximize recovery of threatened and endangered species within the planning area.

**TABLE OF CONTENTS**

EXECUTIVE SUMMARY ..... i

INTRODUCTION ..... 1

PROJECT AREA..... 4

PROJECT DESCRIPTION..... 4

EXISTING CONDITIONS..... 8

FUTURE CONDITIONS WITHOUT PROJECT ..... 17

    Future Without: Northerly Area..... 17

    Future Without: Westlands Water District ..... 19

    Terrestrial Resources ..... 21

    Aquatic Resources and Wetlands..... 21

    Fish and Wildlife..... 22

    Special Status Species ..... 23

FUTURE CONDITIONS WITH PROJECT ..... 23

    Future With Project: Northerly Area ..... 24

    Future With Project: Westlands Water District ..... 24

    Terrestrial Resources ..... 25

    Aquatic Resources and Wetlands..... 26

    Fish and Wildlife..... 26

    Special Status Species ..... 28

SERVICE POLICIES AND APPLICABLE LAWS/GUIDELINES APPLICABLE TO THIS PROJECT..... 28

DISCUSSION ..... 34

    Risks to Wildlife Resources..... 34

    Resource Categories..... 40

SUMMARY..... 43

    Mitigation Approaches..... 43

RECOMMENDATIONS..... 45

REFERENCES ..... 46

## APPENDIXES

- Appendix 1. Long Term Contract Memorandum to Reclamation
- Appendix 2. 2004 Planning Aid Memorandum To Reclamation
- Appendix 3. 2003 Planning Aid Memorandum To Reclamation
- Appendix 4. 2003 NEPA Comment Letter to Reclamation
- Appendix 5. List of Common and Scientific Names Used in this Document

## INTRODUCTION

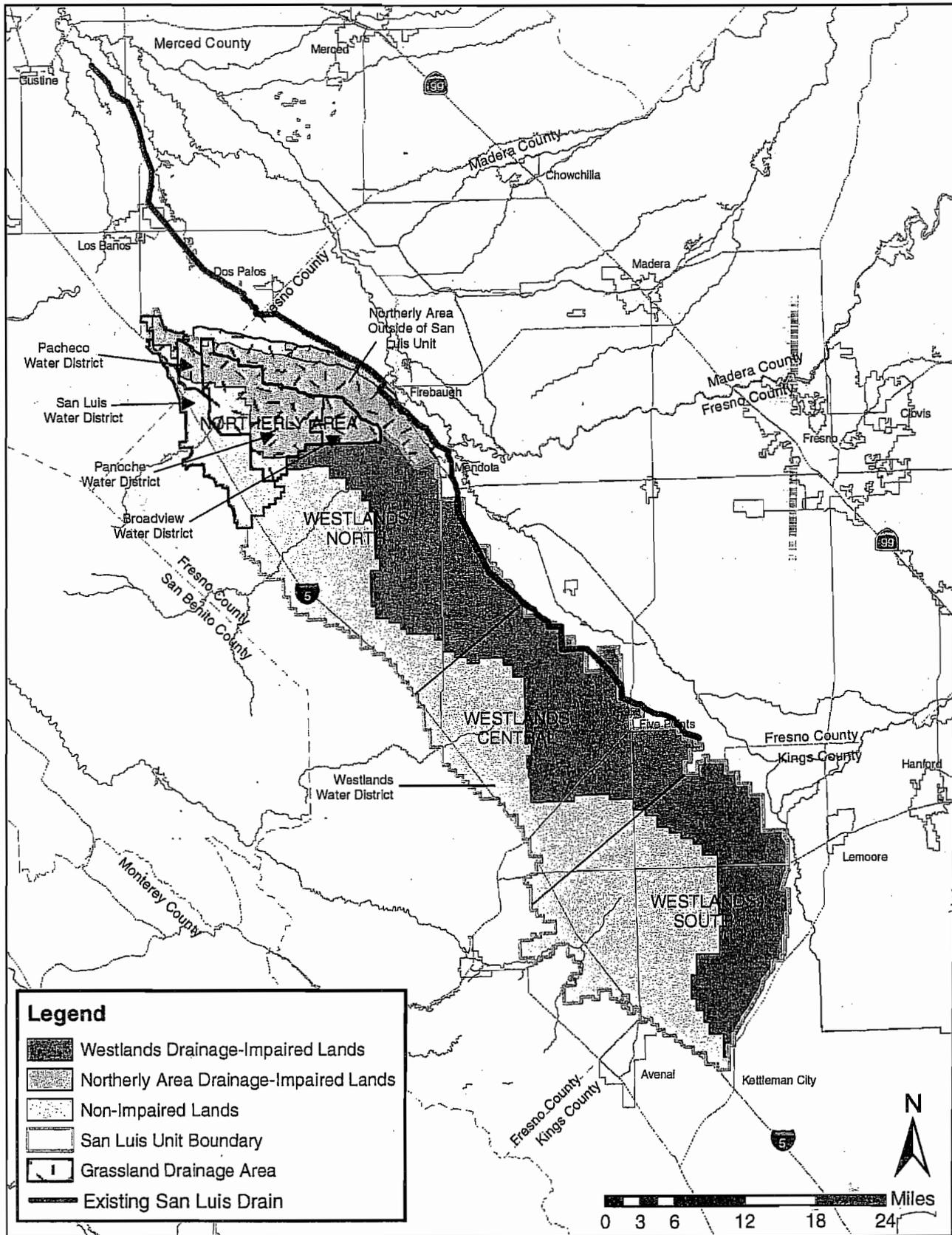
The San Luis Unit has received CVP contract water for about 40 years with only partial drainwater removal services. Sustaining long-term irrigated agricultural productivity in the CVP's San Luis Unit requires drainwater management. The San Luis Act of 1960 (Public Law 86-488) recognized the drainage management requirement and several lawsuit decisions confirmed the Federal government's obligation to provide drainage service. However, the drainage provision methodology remains at issue. Under current land management practices, when irrigation water is provided to the San Luis Unit, a substantial area (379,000 acres) would require drainage service to remove saline groundwater from the shallow water table to maintain agriculture in the foreseeable future (USBR 2004a and 2004b). (See Map #1)

Since 1991, CVP water supplies and institutional constraints have limited the export capabilities of Reclamation's Tracy Pumping Plant. Water supplies and pumping have currently limited Westlands to an average annual water supply of less than 60 percent of full contract quantity over the last decade (Westlands Water District 2002). Despite the reduction in available Delta export water supplies, Westlands has maintained irrigation water quantities near or above contract amounts (Westlands Annual Water Reports 1992-2000) through an aggressive and innovative State and Federal water acquisition/transfer program, along with conjunctive water uses.

During the time spanning the proposed renewal of long-term agricultural contracts (25 years) CVP south of Delta contract deliveries are expected to increase to better meet competing demands (USBR 2004c). Westlands (Westlands Water District 2002) has proposed a land retirement plan encompassing 200,000 acres in exchange for firm future deliveries of about 70 percent (805,000 acre feet) of their full contracted water quantities (1.15 million acre feet). Due to the interrelatedness of this action with long-term contract renewals, we have attached the Service's memorandum to Reclamation regarding San Luis Unit long-term contract renewals (see Appendix 1).

In 1992, the CVPIA was signed into law and directed the provision of "substantial deference" to the San Joaquin Valley Drainage Program (SJVDP 1990) recommendations while implementing the CVPIA. The CVPIA [section 3406(b)(3)] includes permanent land fallowing as a mechanism to acquire water for fish and wildlife purposes. The CVPIA [section 3408(j)] includes consideration of purchase of water rights and purchase and idling of agricultural land to increase project yield. Likewise, reducing San Luis Unit water demands and making water available for other purposes could contribute towards CALFED's goal to improve water supply reliability. Removing drainwater contaminants from agricultural discharges to the San Joaquin River would contribute to CALFED's ecosystem improvement goal.

Since the mid-1990s, other Northerly Area water districts included in the San Luis Unit drainage feature planning effort have benefited from drainage management via the Grasslands Bypass



URS Corporation L:\Projects\San Luis Drainage\WXD\Admin\_Draft\_EIS\_Report\Figure\_1-2\_Drainage\_Study\_Area\_082604.mxd Date: 8/26/2004 10:41:20 AM Name: akkealee

San Luis Drainage Feature Re-evaluation	Drainage Study Area
17324004	

Project. Under the Grasslands Bypass Project, contaminated subsurface drainwater is separated from most wetland supply channels and then discharged into the San Joaquin River via the San Luis Drain and Mud Slough. Loading restrictions were placed on this discharge to regulate water quality in the river over time. On-farm and regional drainage reduction programs have reduced selenium loads, but exceedances continue to occur in the Grasslands wetland supply channels and San Joaquin River. The Grasslands Bypass Project use agreement expires December 2009 and drainage discharge limitations will become more restrictive in the future. Beginning in 2010, more rigorous water quality objectives will apply to the San Joaquin River. As a result, the SLDFR eliminated river discharge as a viable disposal option.

The Plan Formulation Report (PFR) Addendum and ADEIS include evaporation ponds in the Northerly Area as a component of all in-valley alternatives. The Northerly Area encompasses a total of 81,000 drainage-impaired acres, including lands held by San Joaquin exchange contractors and the Delta-Mendota Canal Unit outside of the San Luis Unit boundary. Lands in this area have the highest groundwater selenium concentrations [50 to 1,000 parts per billion (ppb)] within the SLDFR planning boundary.

## **PROJECT AREA**

The project area includes the agricultural districts within CVP's San Luis Unit located in the northwest portion of Kings County, in western Fresno County, and in the southwestern tip of Merced County, California. In addition, the project area includes drainage impaired lands for the San Joaquin Exchange Contractors and Delta-Mendota Canal Unit. The Ocean Disposal Alternative also includes the northwestern tip of Kern County and northern San Luis Obispo County. The Delta Disposal alternatives also include Stanislaus, San Joaquin, Alameda, Solano, and Contra Costa counties.

The SLDFR planning area contains about 730,000 acres, most of which is intensively managed agricultural land. Of these 730,000 acres, about 379,000 acres are, or are projected to be, drainage impaired within the planning horizon. The drainage study area is semiarid, characterized by hot, dry summers and mild winters. Summer temperatures may reach 110 degrees Fahrenheit (F), while winter temperatures may fall below 25 degrees F. Average annual precipitation averages 8.6 inches per year, but ranges from 2.4 to 20.6 inches.

The San Luis Unit includes Westlands in the south and the San Luis, Panoche, and Pacheco water districts in the Northerly Area. The SLDFR planning area also includes districts within the Delta-Mendota Canal Unit (Broadview, Widren, Oro Loma, Mercy Springs, and Eagle Field water districts) and San Joaquin Exchange Contractors (Firebaugh Canal Water District and Central California Irrigation District). All CVP water contract supply sources and supply system's operational issues are outside the project scope. However, the interrelated and interdependent components of all alternatives, including the No Action, will continue to affect aquatic and terrestrial resources Statewide.

The water sources for the San Luis Unit include the San Joaquin, Stanislaus, American, Sacramento, Trinity, and Feather rivers, and at times, most tributaries to these main river systems. The water year type and the CVP/SWP Operational Criteria and Plan (OCAP) (USBR 2004d), coupled with all regulatory requirements will continue to determine available irrigation water supplies for the San Luis Unit. Water conveyed from Folsom, Shasta, Trinity, Oroville, New Melones, and Millerton reservoirs, dependent on contract renewal quantities and Delta pumping constraints, included in OCAP, will continue to supplement the San Luis Unit's water supply. Note that water flow contributions outside of unregulated flood flows from Friant Dam to the San Joaquin River remain the subject of current and ongoing litigation.

## PROJECT DESCRIPTION

Reclamation has identified seven action alternatives, in addition to the No Action alternative, to “meet the needs of the Unit for drainage service, fulfill the requirements of the February 2000 Court Order, and be completed under the authority of Public Law 86-488.” The ADEIS states that the project begins with farmers adopting on-farm and in-district drainage reduction actions regardless of which ultimate drainage solution alternative the Federal government selects. Drainage reduction actions include recycling drainwater, managing shallow groundwater, and reducing canal seepage. Following on-farm and in-district actions, the Federal government compared and contrasted the following alternatives:

- 1) In-Valley Disposal Alternative
  - no new land retirement
  - reported as 44,106 acres retirement [Sumner Peck, Britz settlements, and Central Valley Project Improvement Act (CVPIA) demonstration program]
  - up to 3,290 acres evaporation basins
  - 3,590 acres of mitigation habitat (wetlands)
  - 19,000 acres of regional reuse facilities
  - PFR Addendum, estimated cost - \$0.661 billion, with an annual equivalent cost of \$46.4 million
  - ADEIS, estimated cost - \$0.511 billion, with an annual equivalent cost of \$30.7 million – without mitigation habitat commitment
  
- 2) In-Valley Groundwater Quality Land Retirement Alternative
  - 92,592 acres total retirement (existing 44,106 acres plus an additional 48,486 acres reflecting lands with shallow groundwater quality containing >50 µg selenium/L water)
  - up to 2,890 acres evaporation basins
  - 3,160 acres of mitigation habitat (wetlands)
  - 16,700 acres of regional reuse facilities

- PFR Addendum, estimated cost \$0.719 billion, annual equivalent - \$43 million
- ADEIS, estimated cost - \$0.572 billion, with an annual equivalent cost of \$34.4 million – without mitigation habitat commitment

3) In-Valley/Water Needs Land Retirement

- 193,956 acres total projected retirement [existing 44,106 plus an additional 149,850 acres that include: lands with >20 µg selenium/L water, the 65,000 acres acquired by Westlands that could later be brought back into production with drainage service {Sagouspe} and 10,000 acres from the Broadview Water District]
- up to 2,150 acres evaporation basins
- acreage represents the amount required to “retire enough lands to meet the internal water use needs of Westlands”
- 2,350 of mitigation habitat (wetlands)
- 12,500 acres of reuse facilities
- PFR Addendum, estimated cost -\$0.881 billion, annual equivalent cost of \$53 million
- ADEIS, estimated cost \$0.713 billion, annual equivalent - \$43 million - without mitigation habitat commitment

4) In-Valley/Drainage Impaired Area Land Retirement

- 308,000 acres total projected retirement (44,106 plus 263,894 acres representing the remainder of Westlands drainage-impaired lands, plus the 10,000 acres in Broadview)
- Excludes retirement of lands within the Northerly Area (71,000 acres) currently served by Grasslands Bypass Project
- up to 1,270 acres evaporation basins in the Northerly Area
- 1,390 acres of mitigation habitat (wetlands)
- 7,500 acres (1,700 acres existing) of reuse facilities
- PFR Addendum, estimated cost of \$1.092 billion, annual equivalent \$65.7 million
- ADEIS, estimated cost of \$0.862 billion, annual equivalent \$51.9 - without mitigation habitat commitment

5) Ocean Disposal

- 19,000 acres of regional reuse facilities
- 177 miles of buried pipeline conveyance of drainwater using existing right-of-way when possible, including 3 tunnels through the coastal range and 10 pumping plants
- Estimated total present worth cost of \$0.655 billion (2002 dollars), with an annual equivalent cost of \$39.4 million

6) Delta-Chipps Island Disposal

- 19,000 acres of regional reuse facilities
- 160 acres of selenium treatment facilities
- Utilizes existing San Luis Drain
- 191 miles of pipeline and canal conveyance using existing rights-of-way (108 miles of new construction and 83 miles of the existing San Luis Drain)
- Canals and low-head pipelines in agricultural and sparsely populated areas

- Pipelines in urban and rapid growth areas
- Estimated total present worth cost of \$560 million (2002 dollars), with an annual equivalent cost of \$33.7 million

7) Delta-Carquinez Strait Disposal

- 19,000 acres of regional reuse facilities
- 160 acres of selenium treatment facilities
- Utilizes existing San Luis Drain
- 208 miles of pipeline and canal conveyance using existing rights-of-way (125 miles of new construction and 83 miles of the existing San Luis Drain)
- Canals and low-head pipelines in agricultural and sparsely populated areas
- Pipelines in urban and rapid growth areas
- Estimated total present worth cost of \$0.605 billion (2002 dollars), with an annual equivalent cost of \$36.4 million

No Action

- Part of the Grassland Drainage Area's planned In-Valley Treatment/Drainage Reuse Facility would be included in the No Action Alternative. The constructed and funded components include 2,700 acres of drainwater reuse land for planting with salt-tolerant crops
- Land retirement of 44,106 acres in Westlands, 10,000 acres in Broadview, and assumes the 65,000 acres currently fallowed from the Westlands/Sagoupe Settlement
- The San Luis Drain would not be used to convey drainage except for the Northerly Area of the Unit as part of the Grassland Bypass Project to 2009
- No additional irrigated acres would be brought on line
- No new managed wildlife areas would be developed within the study area
- No changes to land fallowing patterns

All alternatives include irrigator implemented drainage reduction actions previously presented. The initial alternatives screening eliminated land retirement of all SLDFR planning area lands (379,000 acres) needing drainage service.

Except for cost estimates, major components of the project with respect to all out-of-valley alternatives have not changed since the Service's July 2003 and November 2004 Planning Aid Memorandums (PAM). The comments contained in these PAMs regarding environmental effects, ecological monitoring and mitigation remain relevant to the current ADEIS. These two PAMs and our National Environmental Policy Act (NEPA) comment letter are included as Appendices 2, 3 and 4, respectively.

The current aspects of the project that differ from the previous descriptions are the notable inclusion of varying degrees of land retirement; revised cost estimates; and a more precise risk assessment analysis, including modified effluent water quality projections based upon drainwater pretreatment using Applied Biosciences, Inc.'s AbMet<sup>®</sup> treatment technology.

## EXISTING CONDITIONS

The affected environment includes the major CVP and State Water Project (SWP) reservoirs, the Sacramento, American, Feather, Trinity, and San Joaquin rivers, and the Delta. The upland, riparian, and aquatic habitats downstream of major reservoirs on each river system are potentially affected by cumulative CVP and SWP actions. However, biological resources in the water supply source areas are outside the project scope and are not part of this evaluation.

The project area is located in California's San Joaquin River Basin. Actions within the San Luis Unit's water service boundaries influence Service National Wildlife Refuge and CDFG Wildlife Management Area (WMA) water supplies and San Joaquin River water flow and quality. The water delivery areas are intensively managed for agricultural production, including a variety of row crops (e.g., cotton, alfalfa, sugar beets, etc.) and permanent crops (e.g., orchards, vines). All alternatives assume discontinuing Northerly Area drainwater disposal to the San Joaquin River by 2009. The ADEIS states that Northerly Area sump and check drain discharges to the Delta-Mendota Canal would continue unless an action alternative is implemented, or the State issues a discharge abatement order.

*Fish and Wildlife Resources and Agricultural Drainage in the San Joaquin Valley, California* (Moore et. al. 1990) thoroughly describes the condition of the San Joaquin River and associated Basin resources. Since the 1990 publication, several wildlife refuge additions have occurred. The ADEIS (USBR 2004a) includes a brief description of the biological resources in the drainage service area and along pipeline routes. The ADEIS compiled its description from literature searches and Geographic Information System (GIS) mapping. The Service expands the biological resource evaluation in this report.

### **Existing Conditions: Northerly Area**

The Northerly area includes intensively managed agricultural land, irrigation water delivery canals, and drainage canals. The Northerly Area of the San Luis Unit is currently serviced by the Grasslands Bypass Project and subsurface drainwater generated from these fields eventually flows to the San Joaquin River via Mud Slough. In 12 years of monitoring, the Grasslands Bypass Project has documented elevated concentrations of selenium in fish and invertebrates in the natural waterways where subsurface drainwater is being released. These loads may be harming fish in Mud Slough and the lower San Joaquin River, as well as higher vertebrates that consume these organisms.

Sumps and check drains in the Northerly Area continue to discharge drainwater into the Delta-Mendota Canal and Mendota Pool. Releases to the San Joaquin River via the Grasslands Bypass are permitted through the California Central Valley Regional Water Quality Control Board (Regional Board) through 2009.

## **Existing Conditions: Westlands Water District**

In general, agricultural practices limit habitat available for fish and wildlife resources within the identified action area boundaries including Westlands. The Westlands area includes intensively managed agricultural land, irrigation water delivery canals, and drainage canals. As previously noted, the Grasslands Bypass Project facilitates continued drainwater disposal to the San Joaquin River. San Joaquin River tributaries and releases from New Melones Reservoir provide water to dilute the drainage discharges prior to reaching the Delta.

## **Terrestrial Resources**

The San Luis Unit historically supported California prairie (including vernal pools) and San Joaquin saltbush vegetation on the valley floor, and riparian wetland communities along the San Joaquin River (Moore et al. 1990). Today, irrigated agriculture has largely replaced these communities. The practice of planting crops directly adjacent to the river channel bank has confined riparian vegetation to a narrow band within and alongside the San Joaquin River. As of 1990, about four percent of the historic San Joaquin Valley riparian vegetation acreage remained (Moore et al. 1990). There are seven general terrestrial habitat types in the project area, including: drain water reuse areas; restoration sites; San Joaquin saltbush and California prairie/annual grasslands; agricultural and fallowed cropland; and riparian areas. These are discussed in more detail below.

### Drainwater Reuse Areas

The ADEIS identifies 1,700 acres of drainwater reuse sites in the Northerly Area. This land is managed as irrigated agriculture, utilizing drainwater to irrigate salt tolerant plants, primarily alfalfa and barley, which are harvested when mature. These sites function to lower drainwater volume and concentrate salts prior to disposal to the San Joaquin River. The ADEIS states that cultivated plants in the reuse areas consume 3.4 acre-feet of water per acre with an additional 1.1 acre-feet of water per acre reaching groundwater for subsequent drainage service. Land management practices on the reuse areas limit their habitat value.

### Restoration Sites

In the fall of 1998, the Department of the Interior retired 1,646 acres in the SJVDP's Westlands Subarea through the CVPIA Land Retirement Program. In 2001, an additional 440 acres were added to the project. The sites are located immediately to the west and south of the Mendota WMA in western Fresno County. This land was purchased to remove irrigation from impaired lands and reduce drainage problems. Ten monitoring wells revealed that after 4 years, the perched groundwater level dropped 6 feet and in all areas was at least 7 feet below the surface. Monitoring several sumps on the Tranquility site (located about 2 miles south of Mendota WMA) revealed that all sumps were dry by October 2000. This project also presented an

opportunity to monitor and evaluate revegetation and restoration potentials, and will help future restoration actions (USDI 2004).

Currently, the 2,086 retired acres include the only area in the San Luis Unit that the Service believes is permanently removed from irrigated agriculture. The remaining “retired” lands as defined in all proposed alternatives may revert to irrigated agriculture when the groundwater levels drop and irrigation water is available – with the exception of Britz and Sumner Peck lands that cannot use Federal water to irrigate. The ADEIS states that “retired” lands will be used for reuse or evaporation pond sites to the extent possible.

#### San Joaquin Saltbush and California Prairie/Annual Grassland

San Joaquin saltbush is generally dominated by salt-tolerant shrubs such as perennial and annual saltbush, iodine bush, alkali blite, burning bush, and goldenbush. Grasses and forbs found in alkali desert scrub communities include alkali heath, alkali weed, dock, pickleweed, alkali heliotrope, annual saltbush, alkali sacaton, and saltgrass. As of 1990, about eight percent of the historic San Joaquin saltbush habitat remained in the San Joaquin Valley (Moore et al. 1990).

Less than one percent of historic California prairie (dominated by native perennial grasses) remains in the San Joaquin Valley. This habitat is characterized by perennial grasses, such as purple needlegrass and alkali sacaton, are typically found in moist, lightly grazed relict areas within annual grasslands. Most of the historic California prairie habitat is now dominated by annual grassland community. Annual grasslands in the San Joaquin Valley are dominated by introduced annuals such as oats, soft chess, ripgut brome, red brome, barley, and foxtail fescue.

As of 1990, there were about 17,000 acres of California prairie/annual grassland and San Joaquin saltbush habitat remaining in the San Luis Unit—the vast majority of which occur in the western portion of Westlands along the Interstate 5 corridor (USBR 1991). Some wildlife species that use San Joaquin saltbush and California prairie/annual grassland habitats include various species of mice and kangaroo rats, ground squirrels, riparian brush rabbit, blunt-nosed leopard lizard, Swainson's hawk, and red-tailed hawk.

#### Agricultural lands/Fallowed Cropland

Intensively managed or temporarily fallowed agricultural lands are the predominant land use feature in the SLDFR planning area. The ADEIS states that cotton is the main crop followed by tomato and lettuce. Currently, the San Luis Unit growers are shifting their cropping patterns to fruit and nut orchards. Fallowed land management varies, but much of this land is now allowed to grow plants, followed by sheep grazing (pers. comm., Scott Phillips, December 7, 2004).

## Riparian Systems

Remnant native forested and scrub-shrub wetlands, commonly referred to as riparian vegetation, are restricted to the San Joaquin River channel, remnant stands along some intermittent tributaries (such as Los Banos Creek, Panoche Creek, and Cantua Creek), and some of the larger sloughs within, adjacent to, and north of the study area. There are about 500 acres of riparian habitat along Mud and Salt Sloughs (USBR 1991). As stated above, four percent of the historic San Joaquin Valley riparian habitat remains today.

Dominant plant species include cottonwood, California sycamore, and valley oak. Typical shrubs include wild rose, California blackberry, blue elderberry, and willows. Hoary nettle, poison hemlock, rushes, and grasses are commonly found in the herbaceous layer (USBR 1991).

## **Aquatic Resources**

The San Joaquin Basin is drained by the San Joaquin River, which flowing north, eventually empties into the San Francisco Bay via the Delta. Essentially all natural flows in area streams are diverted for agricultural and municipal use. As of the late 1980s, less than one percent of the San Joaquin Valley's developed water supply was delivered to wetlands (Moore et al. 1990). Refuge level 2 actions under the CVPIA have improved wetland water supply reliability, but water supplies are the primary factor dictating the type and condition of wetlands in the Valley.

San Joaquin River flows are currently maintained from tributaries downstream of Mendota Pool through Federal Energy Regulatory Commission (FERC) license required instream flows and water quality flow releases from New Melones Reservoir. FERC flow releases are required to maintain viable fishery resources downstream of associated dams. Prior to 1992, agricultural tailwater and drainwater contributed substantial flows to the river. However, today these river flow contributions have decreased due to tailwater recapture, drainwater volume reduction, groundwater pumping, and water transfer programs.

Numerous kinds of wetlands (including vernal pools, free-flowing streams, and permanent and seasonal wetlands) occurred in the San Joaquin Valley in historical times. Many of these natural habitat types have been reduced to tiny remnants of their historic extent. Existing wetland types are often characterized by man-made or man-modified features such as irrigation canals, managed wetlands (including rice fields), evaporation ponds, and ephemeral groundwater pools. These categories either occur within the SLDFR planning area, adjacent to it, or are potentially affected by water management practices in the study area. About eight percent of the historic San Joaquin Valley wetland acreage remains (Moore et al. 1990). Since the Moore report, several wetland area additions occurred in the San Joaquin Valley, but overall the wetland area remains below 10 percent of historical acreage.

## *Vernal Pools*

Vernal pools, a type of seasonal wetland, once were commonly interspersed within the California prairie of the San Joaquin Valley. These seasonal pools are usually small (10-165 feet across), although some can be as large as a few hundred acres. They are typically shallow (4-24 inches deep), characterized by shallow depressions underlain by an impervious substrate (e.g., clays) that prevents or greatly hinders the downward percolation of water. They vary in pH from acidic to neutral to subalkaline. Plant composition is largely composed of annual, highly endemic flora, and approximately 70 percent of the documented vernal pool species are native annuals (Holland and Jain 1988). Alkali sink habitat, a type of vernal pool or seasonal wetland, occurs in low-lying areas underlain by highly alkaline soils in San Joaquin saltbush habitat. Vernal pools occur throughout the State, and may occur within the boundaries of the project area (USBR 1991).

Two forms of vernal pools are found in the San Joaquin Valley: northern claypan vernal pools, and intergrades with alkali sink pools. Valley pools are typically saline or alkaline, and occur in basins or low-lying plains. Common salt-tolerant flora characteristic of valley pools include: salt grass, *Downingia*, peppergrass, sandwort, locoweed, alkali weed, gum plant, and clover. Terrace vernal pools occur on neutral to slightly acid soils. Characteristic taxa of terrace pools include: foxtail, *Blennosperma*, primrose, white brodiaea, hairgrass, *Evax caulescens*, hedge hyssop, quillwort, toad rush, rush, meadowfoam, flowering quillwort, *Allocarya stipitata*, loosestrife, *Navarretia*, woolly marbles, and several species from the genera *Downingia*, *Eryngium*, *Lasthenia*, and *Orcuttia* (Holland and Jain 1988).

## *Nonnatural Surface Waters (Storage and Conveyance Systems)*

Water related resources begin with the water impoundments, water storage, and water conveyance to respective use areas. Following Delta diversion and conveyance, irrigation water used on SLDFR planning area agricultural lands results in groundwater with high concentrations of salts and trace elements such as selenium. In the Northerly Area, much of this contaminated water is collected using a tile drain system, some of which is ultimately disposed into the San Joaquin River. Additionally, Northerly Area sumps and check drains discharge subsurface drainwater to the Delta-Mendota Canal —flowing to the Mendota Pool. The Mendota Pool provides wildlife management area water supplies to public and private managed wetlands within the region. Westlands currently does not have a disposal outlet, so the contaminated water remains in the groundwater system (except for subsurface drainage accretion flows to the San Joaquin River).

## *Managed Wetlands*

Water supplies limit refuge management strategies. Until 1985, wetland managers relied heavily on agricultural drainwater to meet refuge management objectives. This practice was generally discontinued in the fall of 1985 due to water quality concerns (discussed below). In 1992, the CVPIA identified level 2 refuge water supplies as a project component, and these supplies are

met when possible. As a rule of thumb, at Service National Wildlife Refuges in the San Joaquin Valley permanent wetlands require 10 to 13 acre-feet/acre annually, semi-permanent ponds need 7 acre-feet/acre annually, and seasonal wetlands need 3 acre-feet/acre annually (pers. comm. Kim Forrest, August 11, 2003).

A common wetland/wildlife management approach in the San Joaquin Valley mimics naturally occurring seasonally-flooded emergent wetlands with the carefully timed delivery of a limited water supply. Flat lands are managed as moist soil units and produce stands of swamp timothy, spikerush, smartweed, watergrass, and wild millet that provide food and other winter habitat requirements for waterfowl and other aquatic birds. Sites are drained in mid-March to permit spring seed germination. Beginning in mid-April, about 1 acre-foot/acre of water is applied to encourage the growth of waterfowl foods. Managers begin to flood sites in mid-August, if water is available, and attempt to maintain a depth of 8 inches of water from mid-September through mid-March.

Management of seasonally-flooded emergent wetlands may require from 1.5 to 10 acre-feet/acre of water annually. At the State's Mendota WMA adjacent to the study area, swamp timothy requires 1.5 acre-feet/acre annually while watergrass uses 3 acre-feet/acre. Natural food crops such as swamp timothy, alkali bulrush, smartweed, and millet are grown for wildlife. The canals are periodically dewatered to manage cattail. Under different conditions, watergrass is managed with 5-6 acre-feet/acre annually at Los Banos WMA. Operators of private hunting clubs generally manage their lands less intensively with an average annual application of 3 acre-feet/acre.

A less common wetland management strategy attempts to provide winter roosting, nesting, and brooding habitat for water birds by providing permanent water. Technically, these are semi-permanently and permanently flooded emergent and unconsolidated bottom wetlands (Cowardin et al. 1979), and are limited to sites with uneven terrain that can support a combination of deep ponds, islands, and shallows. Common plants found in deep ponds include common cattail, hardstem bulrush, alkali bulrush, widgeongrass, and horned pondweed. Swamp timothy, spikerush, smartweed, and watergrass are found in the shallows.

Managers of managed wetlands attempt to maximize depths at 3-4 feet from mid-September through early May. Ponds are then drawn down to permit seed germination in exposed shallows. Food plants are then irrigated in early June and again in early July. Relatively few of these "permanent" wetlands contain water year-round. On an annual basis, about one quarter of water use (2.5 acre-feet/acre) is dedicated to filling and maintaining flooded conditions from mid-September through February. An additional 2.5 acre-feet/acre is required to maintain these conditions from March through May. The remaining one-half of the water budget (5 acre-feet/acre) is used for irrigation and counteracting evapotranspiration losses from June through mid-September.

### *Water Delivery and Drainage Canals*

Unlined canals and drains provide marginal wetland and aquatic habitat throughout the project area. The habitat quality varies depending on the degree and frequency of maintenance, water quality, habitat type of adjacent lands, consistency of flows, and other factors. Some canal and drain reaches contain emergent and aquatic plants such as bulrushes, cattails, and pondweed, as well as undesirable invasives such as perennial pepperweed. Larger canals and drains support warmwater fish.

### *Evaporation Ponds*

Evaporation ponds exploit a simple technology where agricultural drainwater is collected and then reduced in volume by sun and wind action. High evaporation rates (2.8 to 5 feet per acre annually) coupled with a shallow (2-3 feet), open basin design with gradual side slopes (up to 8:1) serve to concentrate salts and toxic elements within the ponds. The development of evaporation ponds has created a new and unique habitat that is attractive to the wildlife adapted to the San Joaquin Valley's historic wetlands. Within the San Joaquin Valley, there are about 4,000 acres of evaporation ponds currently in operation, or in the process of being closed. Associated with these evaporation ponds are about 550 acres of mitigation habitat (pers. comm. Anthony Toto).

Evaporation ponds are generally highly saline environments with a geometric mean of 31,850 ppm total dissolved solids (TDS; range 2,675 to 388,000 ppm) (Moore et al. 1990). Extreme salinity conditions within the ponds limit biological diversity. Organisms that can tolerate high and fluctuating salinity and temperatures, and low dissolved oxygen, can exploit a situation in which there is reduced competition and predation. Production of some aquatic food-chain organisms such as widgeongrass, water boatman, midge, brine flies, and brine shrimp is often quite high, and primary production at some ponds has been several orders of magnitude higher than natural saline aquatic systems. The presence of surface water in an arid landscape and abundant food make evaporation ponds very attractive to aquatic birds.

Evaporation ponds on private lands function as permanently-flooded, unconsolidated-bottom ponds. Kesterson Reservoir, which essentially functioned as an evaporation basin between 1981 and 1986, demonstrated the threats these ponds pose to aquatic birds.

Evaporation ponds are regulated under Waste Discharge Requirements issued by the Regional Board. Currently, there is only one operational, dedicated, approved evaporation pond facility within the SLDFR planning area. In 1992, the Sumner Peck pond was closed and the drainage impaired lands were subsequently retired in 2002 in a settlement with Interior. Water quality data from these facilities are provided in Table 1 for reference.

Table 1. Selenium concentrations (conc.) at inflow and within current and historic evaporation ponds located within the SLDFR Planning Area.

POND NAME	MEAN INFLOW CONC. <sup>a</sup> (ppb)	MEAN POND CONC. (ppb)
Sumner Peck <sup>b</sup> (pond owners)	619.3	1,014.0
Britz Deavenport Five Points	81.8	49.7

<sup>a</sup> Concentrations are presented as aggregate geometric means.

<sup>b</sup> Sumner Peck is somewhat atypical in that values for selenium are the highest concentrations discovered to date within the entire San Joaquin Valley and mean pond concentrations exceed California State toxic waste criteria.

### **Fish and Wildlife Resources (Northerly Area and Westlands)**

The rich habitats of the San Joaquin Valley floor historically supported a diverse and abundant assemblage of resident and migratory fish and wildlife species. Today, native habitats have been largely reduced to relic stands isolated in ecological preserves and wildlife refuges. Native wildlife dependent upon these habitats have disappeared or been reduced in numbers. With the exception of some grassland areas in the northern districts, temporarily fallowed cropland, and the CVPIA demonstration restoration sites, the project area is largely irrigated cropland. Wildlife use of this area currently is dominated by species (native and exotic) able to use limited grassland, saltbush, temporarily fallowed cropland, and remnant riparian areas. However, there are many native species using remnant grasslands and grazing lands in the adjacent western foothill locations.

#### Mammals

In general, small mammals are restricted to sites that are not routinely disturbed by cultivation. Typical species associated with the California prairie/annual grassland and San Joaquin saltbush habitats include deer mice, southern grasshopper mice, western harvest mice, house mice, and kangaroo rats. California voles, shrews, raccoons, and several species of bats are found in the valley-foothill riparian habitat. Alfalfa and grain fields also support small mammal populations, although no estimates of abundance are available. Species recorded at the CVPIA restoration sites include western harvest mice, deer mice, house mice, Heerman's kangaroo rats, California voles, shrews, pocket gophers, black-tailed jackrabbits, desert cottontails, and black-tailed hares

(USDI 2004). Mammalian species of concern that are present or may be present in the project area include: San Joaquin kit fox, riparian brush rabbit, and Fresno, giant, and Tipton kangaroo rats.

## Birds

Land management practices in the project area limit bird species diversity and population densities. Most of the waterfowl using the Pacific Flyway winter in California's Central Valley. Some 10 to 20 million waterfowl, along with many other migratory bird species, either winter in or pass through the Central Valley annually. Historically, over 4 million acres of wetlands were available for winter habitat; today, some 300,000 acres of wetlands remain, with approximately one-third in public ownership. Winter habitat is the single most important limiting factor to waterfowl in the Pacific Flyway. The Service ranks the Central Valley wetland habitat as second out of 33 locations on its national habitat priority scale.

Large numbers of migratory, wintering, and breeding waterfowl, shorebirds, wading birds, and other water birds are attracted to the abundant invertebrate food source found at many agricultural drainwater evaporation ponds in the Tulare Basin. The most frequently observed ducks found at these ponds include northern pintails, northern shovelers, mallards, cinnamon and green-winged teal, gadwalls, ruddy ducks, and redheads. Wintering ruddy ducks were observed to use evaporation ponds in greater densities than at nearby private duck clubs or Kern National Wildlife Refuge. Large numbers of eared grebes, American coots, American avocets, black-necked stilts, black-bellied plovers, killdeer, greater and lesser yellowlegs, long-billed dowitchers, dunlin, least and western sandpipers, Wilson's phalaropes, and great blue herons commonly use evaporation ponds. Shorebirds nest on levees and wavebreaks at many of these ponds, including western snowy plover. In addition, evaporation basins occasionally attract visitors including species of management concern such as: Pacific golden plover, marbled godwit, red knot, black skimmer, black tern, and least tern (H.T. Harvey, unpublished data).

A large number of raptors visit the study area either during migration or in search of nesting sites. Migrants passing through the area include bald eagles, peregrine falcon, prairie falcons, northern harriers, Swainson's, ferruginous, and rough-legged hawks. Raptors that nest in the area include northern harriers, short-eared, great horned, and burrowing owls, red-tailed hawks, golden eagles, white-tailed kites, and American kestrels. Peregrine falcons have been observed frequently foraging at evaporation basins, and in two instances sick falcons were recovered by CDFG biologists. Biologists monitored selenium in feathers and blood of these individuals and concluded that selenium toxicosis was likely a factor contributing to the moribund condition of the birds (pers. comm. J. Skorupa).

Additional bird species of management concern that are present or may be present in the project area include: American bittern, least bittern, mountain plover, whimbrel, white-faced ibis, long-billed curlew, burrowing owl, loggerhead shrike, lark sparrow, sage sparrow, grasshopper sparrow, and tricolored blackbird.

## Reptiles and amphibians

Land management practices limit the presence of reptiles and amphibians. However, observations and surveys from the CVPIA demonstration project noted steady colonization from nearby parcels. Reported species include western spadefoot toad, California king snake, and western fence lizard (USDI 2004). Giant garter snakes are known to inhabit certain sites within the SLDFR planning area (Mendota Pool, Mendota WMA). Additional reptile species of concern that are present or may be present in or near the project area include: blunt-nosed leopard lizard, California red-legged frog, and California tiger salamander.

## Fisheries

Regional aquatic fish resources include various anadromous and resident species that reside in, or pass through, not only the San Joaquin River, but the Delta, and Suisun Bay—waterways cumulatively affected by direct and indirect project effects. Common fish species present in the canals include largemouth and striped bass, threadfin shad, Sacramento blackfish, bluegill, white catfish, black bullhead, black crappie, green sunfish, common carp, goldfish, red shiner, inland silverside, fathead minnow, and mosquito fish.

## **Special Status Species**

The Plan Formulation Report and ADEIS determined that of the 87 special-status species (identified by NOAA Fisheries, CDFG, and the Service) only 10 species could be affected to varying degrees as a result of construction and implementation of the in-valley alternatives. The list of species of management concern enumerated above, coupled with the significant potential direct and indirect effects from the varied actions involved with the project, suggest to the Service that this figure may be an underestimate.

## **FUTURE CONDITIONS WITHOUT PROJECT**

Seleniferous drainwater currently is accumulating under many of the downgradient soils of the San Luis Unit. Areas lacking subsurface drainage are impacted to the extent that applied irrigation waters are unable to percolate through to the deep groundwater table, or seep laterally onto adjacent areas. The rate at which the saline water table encroaches on the root zone is a function of application rates, evapotranspiration, and soil permeability.

The ADEIS' (USBR 2004a) assumes under the No Action Alternative that 109,100 acres of irrigated agricultural lands would be retired from agricultural production in Westlands. This acreage figure includes 7,000 acres of CVPIA land retirement, 65,000 acres from the Sagouspe settlement (Sagouspe, et al. v. Westlands Water District, et al. Case No. F-01-6342 OWW LJO), 34,100 acres from the Sumner Peck settlement, and 3,000 acres from the Britz settlement

(Firebaugh Canal Company; Central California Irrigation District; Sumner Peck Ranch Inc., v. United States Department of the Interior: Bureau of Reclamation, Case No. 95-15300, D.C. No. CV-88-00634-OWW). The CVPIA's land retirement program includes 2,086 acres with a land management strategy to restore natural vegetation.

Current language within the ADEIS does not include a permanent land management strategy, and no clear indication is given whether conversion back to agriculture is possible when groundwater levels fall below plant root zones and given available irrigation water. Based on current legal directives, the Service can only determine with assurance that 2,086 acres (the existing CVPIA Land Retirement Program lands) will remain permanently retired from irrigated agriculture. The ADEIS also assumes that Broadview Water District (10,000 acres currently being acquired by Westlands), will be retired from the Northerly Area. However, there is no indication that this land cannot return to irrigated agriculture should drainage service become available.

### **Future Without Project: Northerly Area**

Releases to the San Joaquin River via the Grasslands Bypass are permitted through the Regional Board through 2009. Without drainage service to the Northerly Area (including San Joaquin exchange contractors, Delta-Mendota Canal contractors, and some San Luis Unit contractors) groundwater levels are expected to rise and infiltrate the root zone. In 12 years of monitoring, the Grasslands Bypass Project has documented elevated concentrations of selenium in fish and invertebrates in the natural waterways where subsurface drainwater is being released. These loads may be harming fish in Mud Slough and the lower San Joaquin River, as well as higher vertebrates that consume these organisms.

The initial options available to growers include: further reductions in applied irrigation water through increased efficiencies and fallowing, reductions in drainage via reuse facilities, and terminal disposal via evaporation basins. Delta-Mendota Canal sumps and check drains would continue to discharge flows into the Delta-Mendota Canal absent an action alternative or complying with a State Water Quality Control Board discharge abatement order.

It is likely that growers will implement smaller scale reuse facilities similar to the model being successfully demonstrated at Red Rock Ranch by John Diener. These will require some sort of terminal evaporation component to handle overflow and the highly saline drainage. Solar evaporators were recently granted license to operate (SB 1371) under the provisions that they are part of integrated, on-farm drainage management systems, are equal to or smaller than 2 percent of the total area of these systems, water is applied by timed sprinklers or other equipment allowing application at a rate not exceeding evaporation (to avoid standing water), and that operation of these evaporators does not lead to ground or surface water contamination.

For purposes of this analysis, it is presumed that selenium pre-treatment via AbMet® will not be available and practical at these smaller scales, given the likely expense of operation. Even if

growers got together district-wide to maximize economies of scale, the current AbMet® process remains unproven (it is not clear that growers themselves can bear the burden of research and development of this system at the rate that Reclamation is currently funding). It is furthermore assumed that since the Northerly Area has the highest concentrations of selenium in subsurface drainage, mitigation needs in terms of both dollar and water costs will render evaporation basins prohibitive for individual growers.

Given these constraints, it is reasonable to assume that landowners will continue to sell their lands and water rights to neighboring growers and/or districts (as witnessed in the recent Sagouspe purchase, and the pending acquisition of Broadview Water District lands by Westlands). It is likely that fallowing of agricultural areas would be in part predicted by groundwater quality—in that lands producing subsurface drainage in excess of 1000 ug/L selenium are *de facto* generators of hazardous waste (witness the closure and permanent retirement from irrigation of the Sumner Peck holdings). The lands fallowed earliest would also logically follow the pattern that low-lying areas prone to lateral flows from upslope fields would begin to lose productivity the earliest.

At some level of fallowing, conditions will reach a theoretical equilibrium between application rates, lateral flow, deep percolation, and evapotranspiration. Assisting this relationship will likely be acreages of reuse. These reuse areas serve to increase transpiration of saline drainage and reduce the groundwater table in areas within the influence of these facilities. We presume these will mirror in rough terms what is being proposed for the SLDFR planning, although in this example these acreages may increase owing the lack of evaporation facilities.

Fallowed groundwater levels drop 1.5 acre-feet/year (USDI 2004). Cotton irrigation consumes 3.4 acre-feet/year with 1.1 acre-feet/year/acre reaching the groundwater (page 2-10, USBR 2004a). A conservative “rotational fallowing” scheme would include 1 year irrigation followed by 2 years fallowing. Under this scenario within the Northerly Area, roughly 47,000 acres (66 percent of 71,000 drainage-impaired acres), on average, would be expected to be “retired” from irrigated agriculture within the duration of the 50-year planning horizon. The management of fallowed lands is predicted to follow the Sagouspe example—with much of the lands allocated to sheep grazing (pers. comm., Scott Philips). Dry land farming is another land use option on these fallowed acres.

It is logical to presume that under this aggressive land fallowing scenario, a significant proportion of the current water need for the Northerly Area San Luis Unit will diminish over time. To the extent that this available water will influence regional resource utilization, it is important to speculate as to the likely fate of these “retired” irrigation waters. Again, current examples are the most logical expectation to carry forward. In crude terms, we can presume that fallowing two-thirds of the Northerly Area drainage-impaired lands will reduce the water needs proportionately.

In theory, if irrigation flows to the Northerly Area are reduced by two-thirds, groundwater flow to feed the San Joaquin River will decrease. It is difficult to determine the actual amount of surface water this would involve, as it depends on volumes of accretion flows currently feeding the river. To meet downstream water-right holder obligations, Reclamation may need to find alternate sources to maintain flows within the river channel downstream of the Grassland Bypass discharge site. In this case, some portion of the reduced deliveries would be the logical replacement water source. It is unrealistic to project groundwater flows increasing to the extent they would replace the volume of tile drainwater removed as part of the Regional Board order past 2009. In this circumstance, Reclamation will have to find surface flows to place into the San Joaquin River to meet downstream obligations.

The remnant water made available through fallowing would likely be marketed to other water districts (e.g., Westlands) and to Federal refuges (to meet Level 4 needs) in an assumed ratio of 50:50 (as exhibited by allocations of water from the exchange contractors water marketing program). Note the main water sources for this program are recaptured tailwater and groundwater pumping that previous to the program reached the San Joaquin River.

The above assumptions are based on the expectation that the current water needs analyses for the districts in the Northerly Area (with the exception of the exchange contractors—who hold firm water rights) would not be amended to take into account the fallowing of drainage-impaired lands. If Reclamation chooses to renew the needs analyses in light of cropping pattern changes, irrigation water would be made available for other beneficial uses. The CVPIA (section 3406[a][2]) amends the Central Valley Project Authorizations Act of 1937 to include equal consideration for agricultural, domestic, and fish and wildlife enhancement. The Service assumes that surplus water made available from any future reassessments of district water needs analyses by Reclamation would be partitioned according to this breakdown.

#### **Future Without Project: Westlands Water District**

The “No Action” alternative for Westlands is confounded by a fundamental planning constraint. The U.S. Eastern District of California Court concluded that the Department of the Interior must provide drainage service to the agricultural districts in the San Luis Unit and ordered Reclamation to apply for a Waste Discharge Requirement for Out of Valley drainage disposal in the south Delta (i.e., to complete the San Luis Drain). The U.S. Court of Appeals for the Ninth Circuit confirmed that providing necessary drainwater service was integrally linked to providing delivery of irrigation water, but reversed the District Court’s order directing Reclamation to complete the San Luis Drain, giving the Department of the Interior more discretion in how to meet the obligation to provide drainage service. Under the No-Action alternative, it is likely that Westlands would continue their pursuit for redress under the pending judicial order in the absence of federally-provided drainage service.

When forecasting the events following a No Action scenario, precedent in this case is set by the Sumner Peck and Britz settlements. In these circumstances, Reclamation paid \$107 million, in addition to \$32 million from Westlands, in exchange for the right to prohibit irrigation on 34,000 acres of highly seleniferous lands owned by Sumner Peck Ranch; and \$7.3 million for a similar arrangement with Britz Farms for 3,006 impaired acres. It is presumed that the settlement lands are precluded from future irrigation of any kind (CVP water, pumped groundwater, etc.). It is further assumed that the Department of the Interior is relieved of any future obligation to provide drainage service to the settlement lands, and that irrigation water made available from the “retirement” of these lands will remain in-district.

In December 2002, Westlands laid out a proposal for land retirement of up to 200,000 acres of impaired lands for the price of \$2,500.00/acre—totaling half a billion dollars (Westlands Water District 2002). It is logical to presume under the No Action scenario that the Court would prescribe a settlement encompassing at least the minimal retirement terms of the Westlands Plan of 2002. The plan originally proposed 200,000 acres for permanent fallowing from irrigated agriculture; however it is outlined in the ADEIS that 298,000 acres in Westlands are drainage-impaired. It is not clear why Westlands proposed 200,000 acres as the retirement goal given the figure of 298,000 acres now under consideration. Considering the Westlands argument that the provisions of the San Luis Act (as affirmed in the February 9<sup>th</sup> Circuit decision) direct Reclamation to provide drainage service, it is likely that Westlands would expect service or compensation for the full acreage of impaired lands.

Therefore, for purposes of this assessment, it is assumed that the full acreage of drainage impaired lands within Westlands—namely 298,000 acres—would be retired from irrigated agriculture with Federal money. Westlands would retain title to the lands, as in the case of Sumner Peck and Britz settlements, but would be held to similar use restrictions (no irrigation). The likely use for these impaired lands would be sheep grazing, and perhaps some dry land farming—depending on prevailing market conditions.

Lacking explicit and precise information, we are left to presume that water needs would decrease in proportion to acreage retired. (For purposes of assessment, Westlands’ current contract amount of 1.15 million acre-feet per year minus an average contract deficiency delivery of 30 percent on an annual basis would yield 805,000 acre-feet. In the future condition 1.15 million acre-feet would be reduced by half, as about 50 percent of the land is retired, assuming 100 percent delivery of the remaining water this would yield an average of about 575,00 acre-feet per year. The difference between these would presumably make available a minimum 230,000 acre-feet per year (average annual yield) for other uses within the CVP. Furthermore, Westlands would purchase less water to supplement contract deliveries. If Westlands purchased less water market supplies, more water would be available for other users.

If a significant volume of water that otherwise would have irrigated the eastern (downslope) portions of Westlands is redistributed to the western half of the district, it is not clear if new drainage impairment may eventually manifest. Information has not been provided to ascertain

the expected percolation, lateral transport, and evapotranspiration rates for this region. This potential problem could counter the benefits of fallowing downslope lands—effectively the drainage problem area simply shifted westward. This element of the planning process should be thoroughly evaluated by professional hydrologists and explained in more detail to allow full, long-term assessment of the effects of this plan. For purposes of the analysis it has been assumed that during the 50-year planning horizon for this project, upslope drainage problems would not be an issue.

### **Terrestrial Resources under future without (Northerly Area and Westlands)**

Under the No-Action scenario, most “retired” agricultural lands would be managed as dry-land farms or grazed, however temporarily fallowed lands would likely resume intermittent cultivation if perched groundwater falls below crop root zones. The conversion of large expanses of retired lands to grazing may provide some habitat benefits to terrestrial species. Dry land farming may also contribute some benefits, although land management practices such as weed and insect control are important factors.

Without conservation easements, remaining acreage of California prairie/annual grassland and saltbush plant communities are likely to shift to irrigated agriculture as drainage impaired lands are fallowed. The remnant California prairie and saltbush habitats provide important habitat functions and value, conversion of these areas to row crops would provide minimal habitat function or value.

As mentioned above, some of the “retired” land would be operated as reuse areas. Without the project it is likely that drainwater reuse areas would initially expand before they are retired permanently due to high soil and groundwater salinity. In the interim, the reuse areas may provide some habitat value, but also risk (see **Risks to Wildlife Resources**, following).

### **Aquatic Resources and Wetlands under future without (Northerly Area and Westlands)**

The future without project conditions are dependent on maintaining adequate instream flows and achieving water quality standards to sustain and improve aquatic resources, water quality, and public health. The ADEIS assumes that current Grassland Bypass drainwater discharges to the San Joaquin River will stop by 2009. The ADEIS is silent regarding probable impacts (beneficial or detrimental) to the San Joaquin River as these particular drainwater discharges are ceased. However, sump and check drain discharges to the Delta-Mendota Canal would continue without a specific State action.

Water conveyance canals and drainage canals would continue to provide limited aquatic habitat in the water service area on a seasonal basis. However, because drainwater sump and check drain discharges into the Delta-Mendota Canal would continue, selenium concentrations in Mendota Pool would remain elevated. Under the No Action scenario, it is presumed that uncontrolled seepage and lateral transport of seleniferous groundwater will continue to degrade

area waterways as has been observed in the Grasslands area (Eppinger and Chilcott 2002). Exceedence of selenium objectives in wetland water supplies could adversely affect fish and wildlife resources in the Grasslands area.

Should surplus CVP water become available through fallowing and a subsequent water needs reassessment, there is potential for enhancement of aquatic habitat pursuant to the guidance provided in the CVPIA. The potential benefits to fish and wildlife resources associated with such reallocation would be in proportion to the volume of water provided.

### **Fish and Wildlife Resources (Northerly Area and Westlands)**

Fish and wildlife diversity and abundance are dependent on the available habitat quality and quantity. Habitat conditions without the project are not expected to improve. Further, the detrimental influence from the conversion of remnant native habitats to agriculture will continue to reduce wildlife population size and community diversity.

#### **Birds**

As noted earlier, current land management practices in the project area limit bird species diversity and abundance. The predicted without project conditions would result in converting remnant bird habitats to agriculture. Converting remnant California prairie/annual grassland and saltbush habitat to agriculture would further stress species dependent on those habitats.

Given undisturbed habitat conditions, birds rapidly colonize fallowed land areas. The CVPIA *Land Retirement Demonstration Project, Year Four 2002 Annual Report* (USDI 2004) recorded that bird species (including some of management concern) immediately colonized or frequented the undisturbed parcels. As a result, fallowed areas would provide some benefits to bird species. However, the benefit accrued through increasing the acreage of fallowed land is almost certainly not enough to counteract the detrimental effect to regional bird populations of losing large expanses of remnant native habitat.

#### **Mammals**

Anticipated conversion of remnant California prairie/annual grassland and saltbush habitats would decrease small mammal populations. Based on findings of the CVPIA Demonstration Project (USDI 2004), we expect that small mammals will recolonize retired and/or fallowed lands. The management of these lands will be under the individual grower's discretion, and activities such as discing, chemical weed abatement, and pest control may be harmful to terrestrial mammal species.

## Reptiles and Amphibians

Reptile and amphibian populations would follow the same downward population trend with continued habitat conversions and current land management practices. Drainwater disposal from sumps and check drains to the Delta-Mendota Canal would continue affecting water quality of the Mendota Pool and wetland supply channels potentially affecting aquatic-dependent species such as the giant garter snake.

## Fisheries

The limited fishery resources supported by delivery and drainage canals would not change without the project. However, the ADEIS assumes that Northerly Area drainwater discharges to the San Joaquin River will stop by 2009. The ADEIS does not identify a water source to replace lost river flows. The ADEIS states that discontinuing surface collected drainwater releases to the river will improve water quality. The Service agrees that removing a pollution source lessens river deterioration if all other parameters remain at unchanged.

## Sensitive Species

The level of effect to federally listed species (and other special status species) in the future without the project is difficult to determine. The ADEIS states that no significant impacts on special-status species would be expected to occur under the without project. However, it should be assumed the current trends of general habitat loss and population decline would continue and possibly increase over time. Irrigation water made available from retirement of drainage-impaired lands could be used to convert areas of remnant habitat.

## **FUTURE CONDITIONS WITH PROJECT**

The ADEIS does not identify a preferred alternative. In general terms, Reclamation is currently evaluating seven alternatives and a "No Action" alternative. Based on the Service's knowledge of the project, two alternatives being proposed, Ocean Disposal and Delta/Bay Disposal, are unlikely to be constructed due to engineering and permitting related issues.

The wildlife risks associated with the three Out-of-Valley drainage solutions detailed in the ADEIS are inadequately addressed or enumerated. These omissions skew the risk assessment, and underestimate the potential adverse effects of these alternatives. The Service believes these options involve real and potential risks to fish and wildlife species, including threatened, endangered, and sensitive species (from both construction and operation of these disposal options).

If Reclamation intends to carry these options forward through the planning process, a thorough risk assessment, mitigation, and mitigation monitoring components would have to be developed

that adequately characterize these attendant risks. Should Reclamation ultimately select one of these two alternatives, the Service will need to amend this report accordingly.

Due to time constraints, and clear indication from Reclamation that the preferred alternative would likely be from among the suite of In-Valley options, our detailed comments and assessments are limited to these four alternatives.

Because Reclamation has not identified a preferred alternative at the present time, numerous details have not been provided related to exactly what an In-Valley alternative would look like, specifically with regards to where evaporation ponds and reuse areas would be located, acres and location of compensation measures, and what level of selenium would actually be found in evaporation ponds and reuse areas. As a result, the Service's evaluation in this Report is generalized and is reflective of our assessment of impacts and benefits of the project regardless of the alternative chosen. The Service will provide a more specific analysis in our final Report based on a specific preferred alternative being chosen by Reclamation, and Reclamation's provision of specific and complete information about that preferred alternative to the Service.

### **Future With Project: Northerly Area**

The proposed features of the various alternatives are detailed in the ADEIS. All in-Valley alternatives presented in the ADEIS include retiring all of the Broadview Water District (10,000 drainage-impaired acres) with the construction of evaporation basins and reuse facilities in the Northerly Area to provide drainage service for the remaining drainage-impaired agricultural land (71,000 acres).

The Delta-Mendota Canal sumps are connected to the drainage features, so Mendota Pool discharges from these sources would stop. Treatment facilities include 1,270 projected acres of evaporation basins, 1,390 acres of compensation habitat, and 7,500 acres of reuse facilities (of which 1,700 acres are already in place in Panoche Water District).

Discharges to the San Joaquin River will end in 2009, and Reclamation would need to secure additional water to replace water lost to downstream water-right holders. Replacing lost river flows to maintain water supplies for downstream water-right holders may be required, but this issue is not addressed. The amount needed in all alternative scenarios would not change, however, the source of the water likely would. Under both the In-Valley and Water Needs alternatives, replacement water flows would come from new supply, as no water is released for other beneficial uses from these two alternatives. Even under the maximum retirement scenario (Drainage Impaired Lands alternative), the ADEIS indicates that no water would be made available despite the fact that about one-half Westlands and all Broadview Water District drainage-impaired lands would be retired.

All In-Valley disposal options mentioned in the ADEIS include identical provisions for reuse and evaporation basins in the Northerly Area. These will effectively shift most risk to fish and

wildlife away from Mud Slough and the San Joaquin River and to wildlife, notably migratory birds, opportunely using these drainwater disposal facilities (i.e., evaporation ponds and reuse areas).

### **Future With Project: Westlands Water District**

Under the current suite of alternatives detailed in the ADEIS, project elements within Westlands would include from 34,000 to 298,000 drainage-impaired acres “retired” with from 0 to 2,020 acres of evaporation basins and up to 2,525 acres of compensation habitat based on the PFR assumption of 1.25 acres of mitigation for every acre of evaporation pond constructed (Table 5-1, USBR 2004b). These acreage figures depend on drainage-impaired lands remaining in irrigation.

A total of up to 11,500 acres of reuse facilities are proposed to reduce drainwater volume in Westlands. Evaporation pond and reuse area features represent the most significant direct environmental risk factors associated with the current project. An indirect risk of concern is the possible additional water being reallocated for agriculture on areas not currently being cultivated on threatened and endangered species habitats within and immediately adjacent to the SLDFR planning area. These risks are discussed further in the Discussion Section.

### **Terrestrial Resources under Future with Project (Northerly Area and Westlands)**

The Northerly Area includes 71,000 drainage-impaired acres plus 10,000 acres in Broadview Water District. All In-Valley options propose 1,270 acres of evaporation ponds, 1,390 acres of compensation habitat, and 7,500 acres of reuse sites.

The Westlands’ identified project boundaries include about 606,000 acres (298,000 drainage-impaired) of intensively cultivated agricultural land. The project would result in converting up to about 13,520 acres of agricultural land with low habitat value to evaporation ponds and reuse areas. The With Project alternatives propose removing irrigation from up to an additional 254,000 drainage-impaired acres (ADEIS states 44,000 acres are currently removed) or providing full drainage service. The ADEIS notes that, to the extent possible, existing fallowed land will be used for drainage treatment, reuse, and disposal facilities. So, we assume that: 1) up to 2,020 acres of “retired” lands would be used for the proposed evaporation ponds; 2) up to 11,500 acres would be used for regional reuse and treatment facilities; and 3) up to 2,200 acres would be used to mitigate for evaporation pond impacts.

The Service assumes that within the SLDFR planning area, a total of 22,290 acres of low wildlife value agricultural or temporarily fallowed land would be converted to areas potentially hazardous to wildlife (reuse, treatment, and evaporation ponds). The ADEIS notes that, to the extent possible, existing fallowed land will be used for drainage treatment, reuse, and disposal facilities. Even though reuse areas pose a potential threat to wildlife, there is no mention of mitigation or compensation for up to 19,000 acres (reuse areas) irrigated with drainwater

contaminated with salts and selenium. In this report the Service assumes that the 3,290 acres of habitat compensation for the evaporation pond complexes would require up to 13 acre-feet per acre annual water supply totaling 42,000 acre-feet/year.

The ADEIS' In-Valley options identify retiring up to 298,000 acres in Westlands and 10,000 acres (Broadview) in the Northerly Area. Retired lands would provide high to low value terrestrial habitats dependent on the selected land management strategy. A final land management plan would allow a determination on the future value to terrestrial resources.

### **Aquatic Resources under Future with Project (Northerly Area and Westlands)**

It remains unclear if CVP water supply increase and/or demand reduction actions would occur to assure meeting baseline environmental needs while accommodating present uses and/or projected state-wide growth. The baseline analysis in the ADEIS is silent on the water supply/demand elements of the project. There is no mention of an environmental health and safety baseline water volume determination. The Service assumes that these issues will be addressed in long-term contract renewals; however, Reclamation should identify if this is not the case.

The limited aquatic resources within the project boundaries are not likely to change. As with the "No Action" Alternative, San Joaquin River drainwater discharges will cease by 2009, except for groundwater accretion flows to the River. The ADEIS assumes that current Grassland Bypass drainwater discharges to the San Joaquin River will stop by 2009. The ADEIS is silent regarding probable impacts (beneficial or detrimental) to the San Joaquin River as these particular drainwater discharges are ceased.

The In-Valley disposal options for the San Luis Unit propose up to 3,290 acres of evaporation ponds (Kesterson was 1,200 acres) with a projected influent selenium concentration of 10 ppb. The evaporation pond complexes may include up to 3,590 acres of mitigation habitat in an attempt to draw wildlife away from the ponds. Water supplies for mitigation areas are not identified, but the ADEIS states that the water would not come from contract supplies. Reclamation should provide estimates of where this water would come from in the Final EIS. The ADEIS includes monitoring to determine the final mitigation and/or compensation acreage. A remedial action plan, if mitigation and/or compensation fail, is not discussed.

### **Fish and Wildlife Resources under Future with Project (Northerly Area and Westlands)**

Fish and wildlife diversity and abundance are dependent on the available habitat quality and quantity. The predicted with-project habitat conditions depend on the magnitude of land retirement and subsequent land management practices. Wildlife use data on about 102,000 acres of existing non-irrigated, grazed drainage-impaired land is not available. However, this land could revert to agriculture when elevated groundwater levels lower below root zones and if irrigation water is provided. The Service assumes that the with-project condition includes the

potential to convert the remnant natural habitat (consisting of California prairie/annual grassland and saltbush habitats) to agriculture.

## Birds

As noted earlier, current land management practices in the project area limit bird species diversity and abundance. A definitive land management strategy for potentially retired lands will be required in order for the Service to predict habitat value for birds. We project that Westlands will reallocate irrigation westward as drainage-impaired lands are fallowed, resulting in conversion of natural habitat within and adjacent to the SLDFR project area further stressing species dependent on these habitats.

As stated above, “retired” land value to wildlife depends on the adopted land management strategy. Given current knowledge of fallowed land regeneration, adequate habitat would rapidly establish on these fallowed lands, being rapidly colonized by many bird species. The CVPIA *Land Retirement Demonstration Project, Year Four 2002 Annual Report* (USDI 2004) recorded that bird species, including some of special concern, immediately colonized or frequented the undisturbed parcels.

The risks to birds associated with evaporation ponds with high selenium include both lethal and sublethal effects. Given the uncertainties with the proposed drainwater treatment technologies and installing up to 3,290 acres of evaporation ponds, the Service predicts significant lethal and sublethal effects to both migratory and non-migratory bird species. The ADEIS proposes structural designs to discourage shore bird use of evaporation ponds and the monitoring of bird deaths and deformities prior to committing to mitigation.

## Mammals

The anticipated conversion of remnant California prairie/annual grassland and saltbush habitats associated with both agricultural and urban development would decrease small mammal populations. Based on findings of the CVPIA Demonstration Project (USDI 2004), we expect that small mammals will recolonize retired and/or fallowed lands.

Depending on the location and size of potentially “retired” lands, significant mammal habitat improvement is possible. The precise habitat value would depend on whether and how much of the selected land management strategy would be implemented over time and for how many years the retired lands would be left “unmanaged” between periods of intense agriculture. The management of these lands will be under the individual grower’s discretion, and activities such as disking, chemical weed abatement, and pest control may be harmful to terrestrial mammal species.

## Reptiles and Amphibians

Reptile and amphibian habitat may improve depending on management of potentially retired lands. Under current agricultural land management practices, impacts to terrestrial species would follow the same downward population trend with continued habitat conversions.

Water quality in the Mendota Pool and wetland supply channels is expected to improve as discharges from the Delta-Mendota Canal sumps are collected and disposed via project features (e.g., pipelines, reuse, and evaporation ponds). This could provide a benefit to aquatic-dependent species such as the giant garter snake.

## Fisheries

The limited fishery resources supported by delivery and drainage canals would not change with the project. However, the ADEIS assumes that Northerly Area drainwater discharges to the San Joaquin River will stop by 2009. The ADEIS does not identify a water source to replace lost river flows. The ADEIS states that discontinuing surface collected drainwater releases to the river will improve water quality. The Service agrees that removing a pollution source lessens river deterioration if all other parameters remain at least unchanged. With the project, highly contaminated groundwater accretion flows to the river would continue with less dilution flows. Data related to quantity and quality of groundwater reaching the river is not available at this time so impacts could not be determined.

## Sensitive Species

The level of effect to federally listed species (and other special status species) in the future with the project is difficult to determine. However, this will be addressed in the associated consultation under section 7 of the ESA. Because retired lands could present a significant opportunity to improve habitats for the recovery of upland listed species, the Service and project proponents continue to discuss the habitat improvement potentials and possibilities for retired lands.

## **SERVICE POLICIES, LAWS AND GUIDELINES APPLICABLE TO THIS PROJECT**

### **Service Mitigation Policy**

The Service's Mitigation Policy of January 23, 1981, as issued in the Federal Register Vol. 46(15): 7656-7663, outlines how the Service will work with partners to help mitigate any adverse impacts from land and water development projects on fish, wildlife, and their habitats. The purpose of this policy is to help assure consistent and effective recommendations by outlining policy guidelines for the levels of mitigation needed as well as the various methods for accomplishing the mitigation. In addition, it allows Federal action agencies and private

developers to anticipate Service recommendations and plan for mitigation measures early, thus avoiding delays late in the planning process.

Under the Service's Mitigation Policy, resources are divided into four resource categories to ensure that recommended mitigation is consistent with the fish and wildlife habitat functions and values involved. How a proposed action affects selected (evaluation) species within their corresponding habitats is one element of determining what mitigation the Service will seek for the project. The categories cover a range of habitat functions and values, from those considered to be unique and irreplaceable, to those believed to be much more common and of relatively lesser value to fish and wildlife. Each of the four resource categories has criteria with specific mitigation goals. The criteria are: 1) areas of high value for the evaluation species and are unique and irreplaceable; 2) areas of high value for the evaluation species which are scarce or are becoming scarce regionally; 3) areas of high to medium value for the evaluation species which are relatively abundant; and 4) areas with medium to low value for the evaluation species. The respective mitigation goals are: 1) no net loss of existing habitat value; 2) no net loss of in-kind habitat value; 3) no net loss of habitat value while minimizing loss of in-kind habitat value; and 4) minimize loss of habitat value.

The Service reviews a variety of criteria to outline mitigation recommendations and determine the agency's position on a specific project or proposal. The criteria are not mutually exclusive, and are meant to provide a framework for the Service to fulfill its technical assistance role to Federal action agencies and the public. The action agencies are then charged with making the final decision to approve the proposal and require some level of mitigation, if appropriate. In this process, the Service considers whether:

- (1) Proposals are ecologically sound;
- (2) The least environmentally damaging reasonable alternative is selected;
- (3) Every reasonable effort is made to avoid or minimize damage or loss of fish and wildlife resources and uses;
- (4) All important recommended means and measures have been adopted with guaranteed implementation to satisfactorily compensate for unavoidable damage or loss consistent with the appropriate mitigation goal; and
- (5) For wetlands and shallow water habitats, the proposed activity is clearly water dependent and there is a demonstrated public need.

### **Migratory Bird Treaty Act**

Federal courts have recently affirmed that Federal agencies are subject to prohibitions in the Migratory Bird Treaty Act (MBTA), including restrictions on "take" of migratory birds.

The MBTA prohibits the intentional or unintentional takings of migratory birds except under specific authorized and permitted activities. On January 10, 2001, Executive Order 13286 (EO) was signed by the President of the United States. The EO requires Federal agencies to

incorporate migratory bird conservation measures into their agency activities. Furthermore, the EO stipulates that Federal agencies are required to develop a Memorandum of Understanding (MOU) with the Service outlining how the agency will promote conservation of migratory birds. The MOU will outline how the Federal agency will:

- (1) support the conservation intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions;
- (2) restore and enhance the habitat of migratory birds, as practicable;
- (3) prevent or abate the pollution or detrimental alteration of the environment for the benefit of migratory birds, as practicable;
- (4) design migratory bird habitat and population conservation principles, measures, and practices, into agency plans and planning processes (natural resource, land management, and environmental quality planning, including, but not limited to, forest and rangeland planning, coastal management planning, watershed planning, etc.) as practicable, and coordinate with other agencies and nonfederal partners in planning efforts;
- (5) within established authorities and in conjunction with the adoption, amendment, or revision of agency management plans and guidance, ensure that agency plans and actions promote programs and recommendations of comprehensive migratory bird planning efforts such as Partners-in-Flight, U.S. National Shorebird Plan, North American Waterfowl Management Plan, North American Colonial Waterbird Plan, and other planning efforts, as well as guidance from other sources ...;
- (6) ensure that environmental analyses of Federal actions required by the NEPA or other established environmental review processes evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern;
- (7) provide notice to the Service in advance of conducting an action that is intended to take migratory birds, or annually report to the Service on the number of individuals of each species of migratory birds intentionally taken during the conduct of any agency action, including but not limited to banding or marking, scientific collecting, taxidermy, and depredation control;
- (8) minimize the intentional take of species of concern by: (i) delineating standards and procedures for such take; and (ii) developing procedures for the review and evaluation of take actions. With respect to intentional take, the MOU shall be consistent with the appropriate sections of 50 C.F.R. parts 10, 21, and 22;

(9) identify where unintentional take reasonably attributable to agency actions is having, or is likely to have, a measurable negative effect on migratory bird populations, focusing first on species of concern, priority habitats, and key risk factors. With respect to those actions so identified, the agency shall develop and use principles, standards, and practices that will lessen the amount of unintentional take, developing any such conservation efforts in cooperation with the Service. These principles, standards, and practices shall be regularly evaluated and revised to ensure that they are effective in lessening the detrimental effect of agency actions on migratory bird populations. The agency also shall inventory and monitor bird habitat and populations within the agency's capabilities and authorities to the extent feasible to facilitate decisions about the need for, and effectiveness of, conservation efforts.

If evaporation pond complexes are authorized and approved, the MBTA states that a Memorandum of Understanding with the Service is needed to outline the project's migratory bird conservation measures.

### **Central Valley Project Improvement Act**

On October 30, 1992, the President signed into law the Reclamation Projects Authorization and Adjustment Act of 1992 (Public Law 102-575), which included Title XXXIV, the CVPIA. The CVPIA amends previous authorizations of the California CVP to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic water supply uses, and fish and wildlife enhancement having an equal priority with power generation.

Purposes of CVPIA are defined as follows in section 3402 of the Act: a) to protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River basins of California; b) to address impacts of the CVP on fish, wildlife, and associated habitats; c) to improve the operational flexibility of the CVP; d) to increase water-related benefits provided by the CVP to the State of California through expanded use of voluntary water transfers and improved water conservation; e) to contribute to the State of California's interim and long-term efforts to protect the San Francisco Bay/Sacramento-San Joaquin Delta Estuary; and f) to achieve a reasonable balance among competing demands for use of CVP water, including the requirements of fish and wildlife, agriculture, and municipal, industrial, and power contractors.

### **Endangered Species Act**

Under the Endangered Species Act of 1973 (as amended), all Federal agencies shall seek to conserve endangered species and threatened species and utilize their authorities in furtherance of the purposes of the Act. Also, all Federal agencies shall cooperate with State and local agencies to resolve water resource issues in concert with conservation of endangered species [section 2 (c) (2)].

If a listed species may be present in a project area, the action agency shall prepare a biological assessment to identify any endangered species or threatened species which is likely to be affected by the action.

If a listed species may be affected by the action each Federal agency, in consultation with the Service, shall insure that any action authorized, funded, or carried out by the action agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species.

### **Related Projects or Reasonably Foreseeable Inter-related Actions**

In addition to the proposed action, other related actions being studied or being implemented by Reclamation while the following actions or processes are not directly related to the proposed action they will, or are likely, to influence or have an affect on any final decision made on the DEIS.

#### OCAP and SDIP

OCAP was developed to continue to operate the CVP and SWP in a coordinated manner to divert, store, and convey project water consistent with applicable law. OCAP-associated actions include: increased flows in the Trinity River, an intertie between the California Aqueduct and Delta Mendota Canal, the Freeport Regional Water Project, water transfers, and renewal of long-term CVP water service contracts.

The purpose of the South Delta Improvement Project (SDIP) is to increase water supply south of the Delta, ensure water quality and quantity to agricultural diverters within the south Delta, and to reduce straying of Central Valley fall run Chinook salmon in the south Delta (SDIP 2003). SDIP includes the following actions: increased pumping at the SWP Banks Pumping Plant, permanent barriers operated in the south Delta, water transfers, a long-term environmental water account (EWA), and various operational changes identified as CVP-SWP project integration.

#### CVP Long-Term Contract Renewals

Pursuant to section 3404 (c) of the CVPIA, Reclamation is in the process of renewing existing long-term CVP water service contracts. The renewals are subject to a separate, tiered analysis that is consistent with NEPA tiering described in the Programmatic EIS for the CVPIA. Reclamation proposes to renew 114 CVP water service contracts throughout the Central Valley. These contracts include an annual maximum quantity of 5.6 million acre-feet of CVP water and provide water service to 3.2 million irrigable acres of land and an urban population in excess of 4.3 million. Reclamation intends to have most of the long-term CVP renewal contracts signed in 2005, including those contracts involved in the SLDFR planning area (i.e., San Luis Unit and Delta Mendota Canal Unit). The terms of the CVP long-term contract renewals will be 25 years for agricultural and combined agricultural and M&I contracts, and 40 years for M&I only

contracts. The effects of renewal of long-term contracts over the next 25-40 years will undoubtedly have a significant impact on future land use, and the ability for the CVP to meet demands and obligations, including agricultural, domestic, and fish and wildlife enhancement. The environmental effects of long term contract renewals are being evaluated under separate NEPA analyses and ESA consultations.

### Litigation on Friant Division Long-Term Contracts

In 2003, the Natural Resource Defense Council et al. filed a seventh amended complaint against Reclamation et al. over its operation of Friant Dam and long-term renewal of water supply contracts for the Friant Division (NRDC et al. v. Kirk Rogers (Reclamation) et al. 2003; Case No. CIV-S-88-1658 U.S. District Court for the Eastern District of California). The complaint alleges violations of: 1) section 8 of the Reclamation Act of 1902, section 5937 of the California Fish and Game Code, and the Administrative Procedure Act (APA); 2) NEPA and APA; and 3) Various aspects of ESA and APA; and 4) Federal Reclamation Law and APA. Of the claims filed in 2003 by the plaintiffs, the judge has heard arguments and ruled on the complaint regarding section 5937 of California Fish and Game Code. In August 2004, U.S. District Judge Lawrence K. Karlton found that Reclamation was not operating Friant Dam in a manner consistent with section 5937 of CDFG Law. Judge Karlton’s ruling may result in additional flows in the San Joaquin River for the purpose of restoration of anadromous fish. The quantity of this additional flow has yet to be determined in a remedy phase of this case. The remedy phase of this ruling is likely to take place sometime in 2005.

### Consolidated Place of Use: Mitigation for Encroachment Lands

The Final EIR for Consolidated and Conformed Place Of Use (CPOU) for the CVP (SWRCB 1999) identified and analyzed impacts associated with CVP deliveries to encroachment lands (lands within the boundaries of CVP water contractor service areas that have already received CVP water, but are located outside the authorized CVP Place of Use). Of the 45,390 acres of encroachment lands that served CVP water for agricultural purposes, the following encroachment was identified in the San Luis Unit:

<u>San Luis WD</u>	789 acres of alkali scrub
	7,847 acres of annual grassland
	2,032 acres of valley-foothill riparian/fresh emergent wetland
<u>Westlands WD</u>	1,611 acres of valley-foothill riparian/fresh emergent wetland
	6,653 acres of annual grassland
	22,343 acres of alkali scrub

The Final EIR for CPOU (from page 2-91, Section 2.4.2.4 Integration of Encroachment Land Mitigation Needs Into Ongoing Reclamation Programs) stated that, “Reclamation shall be required to develop a schedule for feasible implementation and monitoring of mitigation or

restoration actions subject to approval of the SWRCB. In addition, the SWRCB will also compare each mitigation or restoration project's environmental/habitat benefits with a set of criteria to be developed jointly by Reclamation and the Service, that will assign environmental/habitat target values that need to be restored or mitigated for, pursuant to the approval of the petition to change the CPOU focusing primarily on listed species habitats lost on encroachment lands as identified in Table 2-36 found on page 2-79." Some of the lands proposed for retirement by Reclamation as a part of the SLDFR may potentially serve as a means to address the encroachment land mitigation requirement from the SWRCB.

## DISCUSSION

The ADEIS states that all water made available through land retirement will remain within the control of the respective water districts. Thus, the analysis does not reflect water being made available for unmet project needs, either as a benefit or as an avoided cost. To date, any water supply made available due to land "retirement" or land "fallowing" has been reallocated to meet in-district water needs.

The issues of water supplies and demands are outside the project scope and deferred to other unidentified processes. The scope of this evaluation is based upon the assumption that CVP water currently being used for irrigation within the SLDFR planning area will remain within the service area boundary defined in the ADEIS. Should water be reallocated to other areas outside the current SLDFR planning area, this FWCA report would need to be amended.

The Service is very concerned about the construction and operation of new evaporation ponds—a technology known to carry significant risk to migratory birds, as evidenced by the now closed Kesterson Reservoir. This evaporation facility was the terminal disposal site for subsurface drainwater from lands within Westlands. Kesterson Reservoir became the de facto terminus of the San Luis Drain and its 12 shallow ponds functioned as an evaporation and seepage basin.

The significant wildlife impacts noted at Kesterson Reservoir developed only a short time (2-6 years) after the reservoir began receiving subsurface agricultural drainage water. Kesterson Reservoir was 1,283 acres in size and, on average, received 6,200-7,000 acre-feet of subsurface agricultural drainage water per year from approximately 8,000 acres (between 5,000 and 42,000 acres) of irrigated agricultural land in Westlands. Seven of 12 Kesterson evaporation ponds studied for biological effects exhibited statistically significant adverse biological effects (including impaired hatchability, elevated frequencies of embryo deformities and reproductive failure (Moore, et al. 1990).

Insoluble selenium in area soils is biologically unavailable until oxidized into soluble forms such as selenate or selenite. Selenate is the most common form of selenium in drainwater (Presser and Ohlendorf 1987). Once waterborne selenium in an oxidized state is available, it can be substituted for sulfur in biochemical reactions producing seleno-amino acid analogs. These

seleno-amino acids are then available to build proteins in organisms important in aquatic and terrestrial food chains; selenium (and other contaminants) can bioaccumulate and bioconcentrate in plant and animal species, and biomagnify in aquatic food chains (Bureau 1985).

### **Risks to Wildlife Resources from Project**

Given the design of the proposed SLDFR evaporation ponds, it is anticipated that waterfowl species at greatest risk would be diving ducks, American coots, eared grebes, and some dabbling ducks such as northern shovelers; however, a wide range of avifauna can be expected to frequent the ponds. This would especially be the case during periods of drawdown, when shallow foraging habitat will attract very high numbers of shorebirds and dabbling ducks feeding upon the dense concentrations of invertebrates likely to inhabit these basins.

This eventuality may be exacerbated by the proximity of some of these ponds to area duck clubs and refuges (e.g., the northerly area evaporation basin is proposed immediately adjacent to the south grasslands management area duck clubs). During the hunting season, these ponds will serve as ideal refugia for waterfowl, and ecotoxic risk may effectively be magnified.

Specific risks associated with avian use of evaporation basins have been well characterized (Moore et al. 1990; Skorupa 1998, Gordus et al. 2002; Ohlendorf 2003, among others). These are primarily associated with elevated concentrations of selenium in the subsurface drainwater, but there are also other constituents of potential concern (e.g., boron and salts). These effects are mentioned in the ADEIS, with additional discussion provided in the planning memoranda provided to Reclamation during earlier phases of this process (USFWS 2003; USFWS 2004). As such, specific symptoms will not be enumerated herein. It is sufficient to say that these effects collectively express in either reduced adult survival, and/or impaired reproduction. Either endpoint has negative impacts on migratory bird populations. With the exception of adverse effects to individuals from threatened and endangered species, compensation measures are directed to population-level effects.

Risks associated with reuse facilities have been less characterized to date. Biomonitoring at Red Rock Ranch (John Diener Farms) in 1996 established that the method of furrow irrigation being used was attracting breeding waterbirds. More than 56 percent of 30 assessable embryos were deformed at one site, and both sites that were sampled yielded avian eggs exceeding 25 ug Se/g DW (dry weight). The threshold value for embryotoxic effects is only 6 ug Se/g DW (Skorupa 1998). Since that initial work, monitoring studies conducted by the Service and the California Department of Water Resources at reuse areas have confirmed nesting activity by numerous aquatic species (e.g., killdeer, black-necked stilt, among others) and more terrestrial birds (e.g., house finch, mourning doves, loggerhead shrikes, etc.) in pasture and grain fields.

Reproductive risks associated with the Red Rock Ranch site were some of the highest encountered anywhere. Nest densities were lower however, so in terms of overall risk to the population, these sites are probably less harmful than evaporation basins (on an acre per acre

basis). In monitoring of 13 non-shorebird species, only one deformity was observed among collected eggs (Brewer's blackbird). Exposure for many of these other species was lower than that observed in the ground-nesting aquatic species, as reflected in egg selenium residues.

To date, 23 species of migratory birds have been documented to nest at drainwater reuse sites (Skorupa et al. 2004; Terrill et al. 2004). Avian nests have been located and sampled in every habitat component of the reuse facilities—proving that these sites are capable of attracting foraging and nesting birds. Despite implementation of wildlife management plans intended to eliminate avian nesting in 1997 by the site managers at the Red Rock Ranch and Mendota agroforestry sites sampled by the Service in 1996, additional eggs were found during brief site visits in the spring of 1998.

During the nesting season of 2003 at the Panoche reuse facility, a pasture inadvertently flooded and shorebird nests with significantly elevated egg selenium concentrations were documented. History has shown that avian species are very opportunistic. In a landscape devoid of natural habitat, and given the inevitability of human error or unforeseen circumstances, it can be expected that avian use of reuse facilities is inevitable.

In addition to avian reproductive activity at reuse facilities, there are concerns associated with foraging during non-breeding seasons for migratory avifauna (particularly sensitive species). Mountain plover have been observed foraging at the Panoche reuse facility (pers. comm. J. McGahan). Monitoring of this same site by H.T. Harvey & Associates (Terrill et al. 2004) has confirmed use by the following threatened or species of management concern: white-faced ibis, northern harrier, Swainson's hawk, long-billed curlew, black tern, burrowing owl, loggerhead shrike, and tricolored blackbirds. Of these, burrowing owl and loggerhead shrikes were observed nesting at the facilities. The use of these facilities by terrestrial threatened and endangered mammals has not been monitored to date, so risk to these species are unquantified. Given the available avian use data from limited monitoring activity at reuse facilities, a comprehensive monitoring plan is essential should these project features be constructed and operated.

### **Avoiding Adverse Wildlife Resource Effects Due to Project**

A benefit of the proposed action alternatives is the use of enclosed pipelines as opposed to drainage ditches to convey subsurface drainwater. Monitoring of the region surrounding the Panoche reuse facility (Terrill et al. 2004) has shown that shorebird nesting and use of open conveyance facilities leads to elevated egg selenium concentrations. Egg selenium concentrations in shorebird eggs collected from canal levees ranged well above safe thresholds (from <3 mg/kg to >40 mg/kg) along these selected "reference" areas. To the extent that drainage service would include enclosed conveyance to replace existing open channels, these represent a project benefit to avifauna when compared to existing conditions.

In 2002, Dr. Joseph Skorupa (USFWS) discovered ponding of groundwater and nesting activity near a cotton gin off Mt. Whitney Avenue. Eggs collected from this site had a very high

incidence of embryo deformities, and some of the highest selenium concentrations in eggs observed at any site. The frequency of such events is uncertain, but it is probable this particular site was not unique. To the degree that drainage service would contain and collect excess groundwater in facilities that are controlled, monitored, and adequately mitigated, and to the extent that such sites above exist (currently or in the future); the project can be expected to avoid continued adverse effects to avifauna.

Additional benefits associated with capturing tile drainage currently feeding the Delta-Mendota Canal have already been detailed above. Further, there is potential benefit to wildlife from the management and placement of retired lands. A significant benefit would be realized should land retirement lead to surplus water reallocation within the CVP consistent with the guidelines provided in the CVPIA.

### **Adequacy of Risk Assessment to Date (Effects to Aquatic Resources)**

In 1995, the Service presented mitigation protocols (USFWS 1995a; USFWS 1995b) developed to minimize and compensate the reproductive impacts to the principal species utilizing evaporation basins during the spring and summer seasons. The first of the two protocols (the Alternative Habitat Protocol) prescribes a precise acreage of mitigation (clean habitat placed adjacent to evaporation facilities) designed to dilute selenium exposure to breeding shorebirds. The second protocol (Compensation Habitat Protocol) is designed to compensate for unavoidable losses on the ponds by replacing lost production (as measured in numbers of hatchlings) using habitat placed outside of the expected foraging range of the evaporation facilities. The mitigation protocols are quantitative risk assessment models that are sensitive to both the degree of contamination (selenium concentration in bird eggs), and size of the ponds.

The protocols underwent extensive peer and public review, and meeting the acreage obligations put forth in the respective models, are conditions built into the Waste Discharge Requirements for each pond as regulated by the Regional Board. In addition to meeting these habitat obligations, operators are expected to maintain specific conditions at their facilities (e.g., steep slopes, vegetation control, etc.) to minimize waterfowl attractiveness to the ponds. Operators also report annually to the Regional Board, and limited egg collections are conducted as a biomonitoring tool.

It was intended at the inception of these two protocols that providing the prescribed acreage of breeding habitat year-round would also mitigate for effects to other exposed species using the ponds. No quantitative risk analysis has been completed to determine if this assumption is accurate. A rough comparison reveals that these provisions are not applicable across all possible species. Census data from monitoring conducted in the intervening years (H.T. Harvey & Assoc., unpublished data; Hansen's Environmental, unpubl. data) indicate significant use by diving aquatic birds such as ruddy ducks, eared grebes, and American coots. Existing alternative and compensation habitats, designed as they are for breeding shorebirds, are not suitable habitat for these deeper-water foragers. Unfortunately, evaporation basins constitute very attractive

habitat to these same species; and it is unlikely that any measure of pond design and deterrence such as hazing can be completely effective at keeping these species from foraging at future evaporation facilities.

It was also intended that the Service protocols would be iterative, and in 5 years the performance of the mitigation facilities would be assessed and the protocols re-evaluated. To date, this re-evaluation has not occurred. However, the planning process for the SLDFR has brought the issue to the forefront again.

Over the past 2 years, the Service has participated in the Mitigation Working Group currently completing the risk assessment for the proposed San Luis evaporation basins. As the current protocols are based on measured egg selenium (data clearly not available for the San Luis ponds), it was first necessary to project egg selenium concentrations from influent waterborne concentrations. This has been completed using historic data from existing evaporation facilities. The Service is generally in agreement with this particular portion of the risk assessment as collaboratively finalized, with the significant caveat that we believe the projections for influent waterborne selenium at 10 ug/L based on successful AbMet© pretreatment are premature. The Service recommends running the mitigation protocol calculations through the mutually-derived model using waterborne selenium concentrations under the conditions of both successful treatment, and no pretreatment. Significant differences in model outputs that would be generated and it would become abundantly clear how the efficacy of selenium pretreatment represents another very critical project component. As discussed in the November 2004 interagency memorandum, it is therefore very important to carefully scrutinize this element of the risk assessment and project planning.

Additionally, in adapting the risk assessment for the proposed San Luis ponds, URS Corporation (with input from the Service), has expanded the protocols to include other species expected to be found at the evaporation basins. A key additional endpoint—adult mortality—is also being incorporated to better reflect the range of impacts realized from the operation of these facilities. This addition represents a significant positive step towards a comprehensive treatment of ecotoxic risk to wildlife avifauna; however there remain technical elements of this risk assessment to address before the protocols can be finalized. Specific limitations of the latest risk assessment provided for review are enumerated in the paragraphs following.

The dilution standard for non-breeding effects is currently based on a Least Observed Effect Concentration from mallards of 10 mg/kg in the diet (Heinz et al. 1989; Heinz and Fitzgerald 1993). Fairbrother and Fowles (1990) documented depressed immunocompetence at as little as 2.2 mg/L selenium in the drinking water of mallards. Skorupa et al. (1996) estimate this corresponds to a dietary concentration of 5.5 mg/kg selenium. If this finding is accurate, the No Observed Adverse Effect Level for selenium is somewhere below 5.5 mg/kg in the diet of mallards. Further, this study was conducted under lab conditions, where additional stressors (e.g., winter, competition, predation) are not factors. Considering the existing regulatory threshold for food chain organisms is 4 mg/kg at existing evaporation basins, the Service

suggests that this value be used instead of 10 mg/kg as the target non-breeding dilution standard in the mitigation calculations.

The existing compensation habitat protocol measures lost production, in terms of eggs (actually hatchlings) that are lost due to selenium contamination from exposure at the evaporation basins. There is a prescription to replace lost production in kind by new production at clean compensation habitat. What these protocols do not adequately address is the impact of adult mortality—or the loss of breeding adults from the population.

Demographically, this is a distinctly different event. For example, using the American coot (from Brisbin and Mowbray 2002), for every 100 eggs laid, approximately 75 chicks will hatch under baseline conditions. Of these hatchlings, if we presume a relatively high survival rate to fledging (75 percent), a total of 56 of those 100 eggs will eventually reach full size and fly. A survival rate during the first year of 44 percent (Ryder 1963) leaves a total of 25 birds that will reach recruitment (coots enter the breeding population at 1 year old, though many individuals do not find pair bonds and do not reproduce until 2 years of age). By the second year (survival 49 percent), only 12 birds remain.

Given the age structure that this life table would produce in a normal population, the median age of a coot in the wild would roughly fall between 1 and 2 years old. For purposes of this illustration, and considering 2 years is the best reliable measure for a fully functional adult coot, we shall look at this age class. A single 2 year old coot therefore represents 6.25 hatchlings. From the demographic perspective, loss of that same individual would require 6.25 times the compensation provided by the current breeding-centered compensation protocol.

This illustration belies a further complication with the expanded mitigation protocols. The question arises whether it is preferable to mitigate for effects at the same level they are induced. Where reproductive impairment is concerned, it is logical to mitigate using the provision of clean habitat for nesting avifauna. In the case of migratory and wintering avifauna—when adult and juvenile mortality are the endpoint of concern—it seems more practical to provide clean habitat to increase survival population-wide to the same extent the presence of the proposed contaminated ponds reduces the number of individuals that would have survived had the ponds not been operating. The accurate calculation of this particular amount of habitat is a daunting prospect, and invariably involves broad assumptions and considerable uncertainty.

The Service has been working on the specific quantitative elements of this revised protocol, and a viable conceptual model appears imminent. However, it remains unvalidated to date and certain critical parameters feeding the quantification of acreage should be derived from empirical data to the maximum extent practical. To be complete, the final compensation protocol for adult mortality at the evaporation basins should include an estimate of acreage needed based on the following parameters:

- Survival expected under baseline conditions (no ponds)
- Survival expected from individuals foraging at the evaporation facilities
- Survival expected under ideal conditions (which must exceed baseline for the mitigation to work).
- The affinity in birds (attractiveness) for each habitat type (or population partitioning between habitats).
- Residence time in each habitat compartment (allows scaling to duration of exposure).
- The current baseline habitat status (quantity and quality of existing conditions).

In essence, for each bird lost, there must be another adult survive that otherwise would not if the alternative habitat (and evaporation ponds) did not exist. Survival in the compensation habitat must be enhanced in equal measure to the loss incurred at the evaporation ponds. The degree of this enhancement is a function of the quality and extent of the compensation habitat. Habitat quality directly impacts survival (and likely beneficially effects attractiveness), and the overall acreage of the compensation habitat will provide a greater area to draw away individual birds, as well as more acreage to sustain a population.

The modified Service mitigation protocols are a critical element of the SLDFR. As the original protocols are a significant backbone to the current regulatory framework for the existing San Joaquin Valley evaporation basins, it is presumed the revised protocols will also be enforced as part of the permitting regulations. The Service expects at a minimum that Reclamation will conform to the best available scientific estimate for compensation for evaporation pond facilities proposed as part of all In-Valley alternatives. The Service is committed to work with Reclamation through the Mitigation Working Group to finalize these protocols as soon as possible so that planning and feasibility evaluations can go forwards with the best available information.

Since the transmittal of the November 2004 memorandum on the SLDFR, the Service has convened an internal multi-disciplinary Land Retirement Planning Team. The purpose of this team is to assist in the development of land management plans for the lands to be “retired” by the possible alternatives. The Service has identified lands in the region spanning between Cantua Creek and the Mendota WMA, largely slated for retirement, that may serve as useful lands on which to place restored corridors and easements with land management practices to aid recovery for San Joaquin kit fox (among others).

As discussed in Land Retirement Planning Team meetings (both to date attended by Reclamation), the Service is very concerned about indirect effects of accelerated conversion of native habitats within the western portions of the San Luis Unit delivery area. It seems logical to presume that releasing significant volumes of water for other uses within the discretion of Westlands may lead to expansion of irrigated acreage into these sensitive areas. There remains significant confusion surrounding the mapping boundaries concerning authorized place of use, expansion areas, encroachment areas, and contract service areas for districts both directly

involved with the current project alternatives (i.e., Westlands), and indirectly connected through existing and pending water transfer arrangements (e.g., Coalinga, Avenal, Pleasant Valley, and others).

The Service recommends that clear language be included in the final EIS to provide assurance that detrimental indirect effects to kit fox habitat in the aforementioned areas within the western San Luis sphere of influence are not a consequence of the proposed project. Presumably, land “retirement” will follow the examples in the Britz and Sumner Peck settlements where restrictions will be placed on irrigation water use to “within district” applications alone. Given the volume of water likely to be released through such a settlement, and the prospects for indirect effects, a more explicit definition of these limitations seems in order. This precision calls for a more thorough justification of the district’s water needs such that CVP water might not be shifted to areas that shall only serve to free groundwater for uses outside the current district.

### **Resource Categories**

Many elements of proposed project would occur on low valued agricultural land. However, some cultivated land could be converted to drainwater reuse facilities and evaporation ponds, potentially toxic to wildlife. Also by potentially freeing up water there could be expansion of farming into native/annual grasslands west of Interstate 5.

Through application of the Service’s Mitigation Policy, we have determined the following mitigation planning and goals would apply to the habitats potentially adversely impacted by the proposed action.

- Wetlands and wildlife management areas receiving water supplies from the Delta-Mendota Canal, Dan Joaquin River, and Mendota Pool. The evaluation species for the wetlands habitats found on these areas are the waterfowl guild and shorebird guild. These species were selected because (a) they utilize this habitat for feeding, loafing and breeding, (b) then importance for consumptive and non-consumptive human uses (i.e., waterfowl hunting and bird watching), and (c) the Service’s responsibilities for their management under the Migratory Bird Treaty Act. Wetland habitats are severely reduced in the project area and ecoregion and are valuable for a variety of wildlife species. Therefore, the Service designates this habitat as Resource Category 2. Our associated mitigation planning goal is for “no net loss of in-kind habitat value.”
- California prairie (pastures) salt bush, vernal pools, and riparian habitats. The evaluation species selected for these habitats are Swainson’s hawk, California vole, and migratory birds. Swainson’s hawk was selected because it (a) either nests or forages in one or more of these habitats and (b) has high non-consumptive human uses (bird watching). California vole was selected as an evaluation species because it is a ground-dwelling species in these habitats which serves as a prey species for predatory mammals and birds of prey. Migratory birds were selected because (a) they utilize this habitat for feeding,

loafing and breeding, (b) then importance for consumptive and non-consumptive human uses (i.e., waterfowl hunting and bird watching), and (c) the Service's responsibilities for their management under the Migratory Bird Treaty Act. These habitats are reduced in acreage in the project area and ecoregion and are valuable to a variety of wildlife species. Therefore, the Service has these habitats as Resources Category 2. Our associated mitigation planning goal is for "no net loss of in-kind habitat value."

- San Luis Unit agriculture land growing cotton, tomato, pasture, grain and hay, idled fields, and other agricultural fields. Small mammals were selected as the evaluation species for the above identified agricultural lands in the project area. Small mammals were selected because of their important role in the food chain as prey species for raptors and larger mammals which forage in these lands. Typically, agricultural lands in the project area are characterized by intensive farming. The type of crop grown and past harvest land management practices affect the value of the lands for wildlife (crop type is usually a key factor in assigning value); therefore, the Services designates these agricultural habitats in the project area potentially impacted by the project as Resource Category 4. Our associated mitigation planning goal is "minimize any loss of habitat value."
- All San Joaquin Valley river systems and the Bay/Delta. Anadromous fish and migratory birds were selected as the evaluation species for these habitats. Anadromous fish were selected because (a) they are dependent on these habitat for one or more phases of their life cycle (i.e., spawning, rearing), (b) their importance for consumptive human uses (i.e., sport and commercial fishing), and (c) the State and Federal governments responsibility for their management. Migratory birds were selected as evaluation species because (a) they utilize this habitat for feeding, loafing and breeding, (b) then importance for consumptive and non-consumptive human uses (i.e., waterfowl hunting and bird watching), and (c) the Service's responsibilities for their management under the Migratory Bird Treaty Act.

## **Evaluation of Alternatives**

Any suite of alternatives designed to address San Luis Unit drainage issues should include options which would seek to eliminate the need for drainage service. The Service appreciates the decision to include land retirement as a drainage management tool in the project scope. However, Reclamation's current approach in the SLDFR process unnecessarily confines the range of alternatives for drainage service. The Service believes the project should seek a more permanent and complete resolution of drainage issues in the San Joaquin Valley, while providing mitigation for any associated adverse effects to fish and wildlife species. Land use and modified land management can limit the drainage problem pending a reliable technological drainwater detoxification method. The Service disagrees with providing high-risk drainage service based on unproven treatment systems. Retiring all drainage impaired land continues as our environmentally preferred action. It would maximize avoidance of adverse environmental

effects (both lethal and sublethal), avoid evaporation pond mitigation uncertainties and associated expenditures, and help resolve the drainage problem in a balanced resource management approach.

We believe the Service's Preferred Land Retirement Alternative (*full* retirement) for the San Luis Drain Feature Re-Evaluation Project, as identified below, would release Reclamation from any future obligation to provide drainage service to the San Luis Unit while maximizing avoidance of adverse environmental effects.

#### Service Preferred Land Retirement Alternative

- Retire 379,000 acres of the 730,000-acre SLDFR planning area (estimated cost per acre \$2,600-\$3,000)
- Incrementally retire agricultural land with the first efforts concentrating on about 200,000 acres in Westlands and about 47,500 (see table 2.13-1 DEIS) irrigated acres with tile drains installed responsible for drainage into the San Joaquin River.
- Manage retired lands in a manner which contributes to the benefit and recovery of upland species within the San Joaquin Valley.
- Evaluate alternating years of land fallowing with irrigation following groundwater lowering, dry land farming or other non-water dependent actions on 140,000 acres of remaining drainage impaired land.
- Adjust water contract quantities in accordance with the reduced irrigated acreage and reallocate surplus water in accordance with guidelines established by CVPIA.

The Service believes the following assumptions should be considered when evaluating the impacts and benefits of *full* land retirement which would evaluate retirement of all drainage impaired lands in the San Luis Unit.

#### Example

In this instance, the Service has used Westlands as a *full* land retirement surrogate to propose possible assumptions and allow for an evaluation of the full range of land retirement benefits:

#### Assumptions:

- Westlands includes about 300,000 drainage impaired acres occurring within its legislatively-authorized 600,000-acre boundary.
- Land within Westlands could be purchased at \$3,000.00 per acre. The capital costs to retire all drainage impaired land within Westlands would be \$900 million.
- Westlands receives an annual average 805,000 acre-feet water delivery of its legislatively-authorized 1.15 million acre-feet CVP contract (about 70 percent).

- As an outside bracket, retirement of 50 percent Westlands lands could make available up to 50 percent of Westland's CVP contract water supply (575,000 acre-feet).

#### Potential Benefits:

Based on the assumptions listed above, the Service believes that the water reduction benefit from the Westlands *full* land retirement action could be as much as 230,000 acre-feet annual average water supply with up to 100 percent water delivery for the remaining contract quantity. Any water made available from such land retirement could serve to meet currently unmet fish and wildlife needs.

These features and elements may be further addressed and evaluated concurrent with Reclamation's ongoing analysis of currently selected alternatives, though it would be preferable and advantageous to fold the evaluation into a combined effort. It is our contention that an additional alternative would not require extensive additional planning and effort, reflecting as it does already graded amounts of investment for each respective component (e.g., the price per acre of retired land is derived and multiplied by total retired lands, the cost of evaporation pond operation and maintenance is scaled to final evaporation pond acreage, etc.). Regardless, our contention is that a full retirement alternative represents the most logical and least risky option to finally solve the drainage problem from the perspective of protecting and enhancing regional fish and wildlife resources. This scenario therefore warrants full evaluation as part of the SLDFR planning process.

This land retirement alternative is compatible with CALFED and CVPIA goals and objectives by reducing project water demand, increasing available supplies, enhancing fish and wildlife habitat, and reducing contaminants reaching the Delta. This approach appears to be compatible with both the Service and Reclamation's respective missions. Since the goal is to find a drainage solution for the study area which includes measures to preserve, protect, restore, and enhance fish and wildlife resources affected by water deliveries to the San Luis Unit.

### SUMMARY

The Service has significant regulatory and resource management responsibilities in the California's Central Valley, including the San Joaquin Valley. The Service is very interested in finally resolving the drainage problem in the San Joaquin River Basin, and has actively participated in many past efforts addressing the drainage issue. The Service continues to support the goals of the SJVDP Rainbow Report (SJVDP, 1990), which approached the resolution of the drainage problem by recommending an integrated, comprehensive program of pragmatic actions representing a broad political consensus. However, the Service recognizes that since SJVDP sunsetted, almost 15 years have elapsed. New programs for environmental protection, enhancement, and restoration are on-going under the CVPIA and CALFED, and these dictate a revised focus of the SJVDP's recommendations. The Rainbow Report action components need prioritization to reflect current conditions and objectives.

It is the Service's opinion that Reclamation's current alternatives do not provide equal consideration to fish and wildlife resources. The ability of the Service to successfully implement its mission, and accomplish its regulatory responsibilities, and conservation management objectives at the ecosystem level would be hampered by implementing any of the currently presented alternatives. Although the current alternatives may discontinue Grassland Bypass drainage discharges to the San Joaquin River prior to 2009, none as currently envisioned would contribute to CALFED or CVPIA goals and objectives to improve the Bay-Delta ecosystem, while providing a more reliable water supply. In this action (along with concurrent contract renewals and other decisions), Reclamation is responsible for implementing policies that will undoubtedly have a significant impact upon land and water use within and beyond the San Joaquin River Basin for several decades to come. The Service believes that any decision on this project will be potentially significant to San Joaquin Valley fish and wildlife resources.

### **Mitigation Approaches**

In recommending mitigation for adverse impacts to any of the habitats affected by the proposed project, the Service recommends following, to the extent feasible, the sequential mitigation steps recommended in the Council on Environmental Quality's regulations. These steps favor *avoidance* above *minimization* of impacts and *compensation* for unavoidable adverse effects.

The CVPIA affords fish and wildlife equal status along with agriculture, municipal, and industrial water users. The currently proposed alternatives within the SLDFR do not provide fish and wildlife resources equal status. Current indications from Mitigation Working Group conference calls and language in the ADEIS, suggest that Reclamation hopes to defer implementing mitigation measures for adverse impacts of evaporation ponds subsequent to monitoring and evaluation. It has already been stated that water for mitigation must come from new sources (not from surplus water from retirement) as there will be no surplus from land retirement (pers. comm. M. Delamore).

Mitigation measures must be finalized as integral components of the project prior to any decision on this action in order to determine the acreage and water supply required to offset the potential adverse environmental effects of installing over 3,000 acres of highly toxic evaporation ponds and up to 19,000 acres of drain water reuse acreage. Considering the high degree of uncertainty relating to the attendant risk assessments, this amount of clean freshwater may not be available, and therefore adequate compensation would be infeasible. Early estimates in deriving mitigation acreages during the drafting of the risk assessment section of the ADEIS (which accounted for a range of uncertainty) by URS Corporation contained an estimate for water supplies actually exceeding the contractual amount available to Westlands.

Given such attendant uncertainty in the risk assessment projections, mitigation through **compensation** must include a contingency plan to cease water deliveries to drainage-impaired land and close evaporation pond complexes should treatment, compensation, and mitigation

efforts fail. In such an unfortunate circumstance, adequate mitigation measures would shift the risk back upon the project itself, and in this worst case scenario, Reclamation would be forced to abandon all investments in infrastructure towards In-Valley drainwater disposal and re-evaluate from the remaining options. The Service believes that there is a real possibility that adequate mitigation will be infeasible on a scale required for the full scale In-Valley disposal alternative (>3,000 acres of evaporation basins), and suggests that such disposal options are not the most prudent means to solve the drainage problem.

The Service's clearly favors avoidance to protect fish and wildlife resources. The Service believes that this option is clear and straight forward with respect to the SLDFR, through land retirement. Currently, the ADEIS contains increasing levels of land retirement, and inversely decreasing required acreages of evaporation facilities. However, even the most aggressive land retirement alternative ("Drainage Impaired Lands") still requires extensive evaporation basins coincidentally in the most selenium-laden region (Northerly Area). This alternative still carries significant risks to migratory and birds of management concern

The Service recognizes the value in **minimizing** potential adverse effects. Evaporation basins are a clear and proven risk to migratory birds, including species of management concern. In this light, strategies to minimize source loading such as irrigation efficiency are recognized and valued contributors to reducing exposure. Proposed actions to limit attractiveness to waterbirds (e.g., steeper slopes, vegetation control, hazing, sheet pile pond separators) are useful, but not entirely effective. Many of these measures are already part of the Waste Discharge Requirements for existing ponds within the Tulare Lake Basin, however census data (the same data upon which the current risk assessment protocols are dependent) show that avian use of these modified systems continues. Treatment holds the promise for reducing influent selenium concentrations and perhaps food-chain exposure, but this technology remains unproven (see USFWS 2004). Clearly, the best avenue for risk minimization is to minimize the acreage of evaporation basins. Therefore, the Service finds that eliminating or minimizing the acreage of evaporation basins needed to dispose of drainage water is environmentally-preferred and most protective of fish and wildlife resources.

## RECOMMENDATIONS

The Service provides the following recommendations to Reclamation. We believe implementation of these recommendations will provide a focus on long-term, sustainable ecosystem values, and will lead to a much improved balance of water supply with demands, provide for sustainable agriculture and improved water quality, while increasing the quantity and quality of San Joaquin Valley habitat, possibly providing for the recovery of numerous listed species, and protection of millions of migratory birds.

*(1). Include and evaluate the Service's Preferred Land Retirement Alternative (full retirement). To avoid and minimize risks and effects to fish and wildlife resources in the San Joaquin Valley*

and Pacific Flyway, the Service recommends inclusion and evaluation of a *full* land retirement alternative on all drainage impaired lands in the San Luis Unit in the Final EIS (page X). This alternative would maximize elimination of drainage at its source and avoidance of adverse fish and wildlife effects.

(2). *Consider and include mandates, directives, and requirements of all applicable laws, policies and programs.* The Service recommends that Reclamation, in its efforts to solve San Luis Unit drainage issues, fully consider and include mandates and directives as provided under the CVPIA, the CALFED Bay/Delta Program, the Endangered Species Act, the Clean Water Act, and the Migratory Bird Treaty Act. As an example, retiring drainage impaired lands in the San Luis Unit should reduce water demand such that other unmet needs, including refuge level 4 water supplies, could be met through water made available subsequent land retirement.

(3). *Maximize avoidance and/or minimization of Project impacts to fish and wildlife.* Provide further evaluation of the proposed action and alternatives to assist in avoiding and/or minimizing fish and wildlife impacts associated with construction and operation of evaporation ponds, most notably to migratory birds as defined and protected under the Migratory Bird Treaty Act.

(4). *Fully support efforts of the Mitigation Working Group.* The Service recommends that activities and discussion among the Mitigation Working Group take the highest priority among remaining Reclamation tasks. These activities include: the final derivation of the revised mitigation protocols, discussion of risks associated with reuse facilities and possible mitigation measures, discussion about specific management plans for all project facilities to minimize wildlife attractiveness and exposure, and detailed cost estimation and framing of the Adaptive Monitoring and Management Plans mentioned in the ADEIS.

(5). *Include State Agencies in the Mitigation Work Group.* The Service recommends including the California Department of Fish and Game and California Department of Water Resources in the Mitigation Working Group. Their inclusion would broaden the views of the Work Group and increase its focus on State requirements.

(6). *Include a full range of water demand and supply management options.* The Service recommends including a full range of water demand and supply management options, including improved irrigation efficiency and land retirement and fallowing. [see November 2004 Planning Aid Memorandum (Attachment 4) and July 15, 2003, Planning Aid Memorandum and NEPA comment letter, Attachments 2 and 3]

(7). *Maximize efforts to assist recovery of threatened and endangered species.* The Service recommends that Reclamation provide a more detailed assessment of land management options to maximize recovery of threatened and endangered species within the planning area.

(8). *Initiate and complete consultation under section 7 of the ESA.* The Service recommends that Reclamation initiate and complete consultation under section 7 of the ESA to determine

potential project effects on listed and other special status species, and incorporate appropriate conservation measures for affected species into project implementation. It may also be necessary to consult with NOAA Fisheries on effects to listed anadromous fish species and CDFG for State listed species.

(9). *Initiate and complete consultation under the State Endangered Species Act.* The Service recommends Reclamation initiate consultation with the California Department of Fish and Game to determine the potential project effects on State-listed species.

## REFERENCES

- Brisbin, I.L., Jr., and T.B. Mowbray. 2002. American Coot (*Fulica americana*) and Hawaiian Coot (*Fulica alai*). In *The Birds of North America*, No. 697 (A. Poole and F. Gill, eds.), The Birds of North America, Inc., Philadelphia, PA.
- Burau, R.G. 1985. Environmental Chemistry of Selenium. *California Agriculture*, 39:16-18
- Eppinger, J., and J. Chilcott. 2002. Review of Selenium Concentrations in Wetland Water Supply Channels in the Grassland Watershed (Water Years 1999 and 2000). Staff Report of the California Regional Water Quality Control Board, Central Valley Region. Sacramento, CA. 31 pp.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79/31 U.S. Fish and Wildlife Service, Washington D.C. 103 pp.
- Fairbrother, A., and J. Fowles. 1990. Subchronic effects of sodium selenite and selenomethionine on several immune functions in mallards. *Arch. Env. Contam. Toxicol.*, 19:836-844.
- Gordus, A.G., H.L. Shivaprasad, and P.K. Swift. 2002. Salt toxicosis in ruddy ducks that winter on an agricultural evaporation basin in California. *J Wildl Dis*, 38(1):124-31
- Heinz, G.H., and M.A. Fitzgerald. 1993. Overwinter survival of mallards fed selenium. *Arch. Env. Contam. Toxicol.*, 25(1) 90-94.
- Heinz, G.H., D.J. Hoffman, and L.G. Gold. 1989. Impaired reproduction in mallards fed an organic form of selenium. *J Wildl. Manage*, 53(2):418-428.
- Holland, R.F. and S.K. Jain. 1988. Vernal Pools. pp. 515-533 In: M.G. Barbour and J. Major (eds.), *Terrestrial Vegetation of California*. New Expanded Edition, Calif. Native Plant Soc. Spec. Publ. No. 9, Sacramento, CA.
- Moore, S.B., J. Winckel, S.J. Detwiler, S.A. Klasing, P.A. Gaul, N.R. Kanim, B.E. Kesser, A.B. DeBevec, K. Beardsley, and L. K. Puckett. 1990. *Fish and Wildlife Resources and Agricultural Drainage in the San Joaquin Valley, California*, Volume I and II, San Joaquin Valley Drainage Program, Sacramento, CA.
- NRDC et al. v. Kirk Rogers et al. 2003. U.S. District Court for the Eastern District of California. Case No. CIV-S-88-1658

- Ohlendorf, H.M. 2003. Ecotoxicology of Selenium. Pp. 465-500 *in* D.J. Hoffman, B.A. Rattner, G.A. Burton Jr., and J. Cairns Jr. (eds.) *Handbook of Ecotoxicology, Second Edition*. Lewis Publishers, Boca Raton, FL.
- Presser, T.S., and H.M. Ohlendorf. 1987. Biogeochemical Cycling of Selenium in the San Joaquin Valley, California. *Environ. Manage.* 11:805-821.
- Ryder, R.A.. 1963. Migration and population dynamics of American coots in western North America. *Proc. Int. Ornithol. Congr.*, XIII: 441-453.
- San Joaquin Valley Drainage Program. 1990. A Management Plan for Agricultural Subsurface Drainage and Related Problems on the Westside San Joaquin Valley.
- San Luis Act. 1960. Public Law, 86-488.
- Skorupa, J.P. 1998. Selenium poisoning of fish and wildlife in nature: lessons from twelve real-world examples. Pp. 315-354 *in* W.T. Frankenberger and R.A. Engberg, (eds.), *Environmental Chemistry of Selenium*. Marcel Dekker, Inc., New York, NY.
- Skorupa, J.P., S.J. Detwiler, and T.C. Maurer. 2004. Assessment of Avian Selenium Exposure at Agroforestry Sites, Draft Final Report. U.S. Fish and Wildlife Service, Sacramento, CA.
- Skorupa, J.P., S.P. Mormon, and J.S. Sefchick-Edwards 1996. Guidelines for Interpreting Selenium Exposures of Biota Associated with Nonmarine Aquatic Habitats. Prepared for the National Irrigation Water Quality Program. U.S. Fish and Wildlife Service, Sacramento, CA.
- Terrill, S.B., B.B. Boroski, and J. Seay. 2004. San Joaquin River Water Quality Improvement Project, Phase 1 Wildlife Monitoring Report, 2003. Prepared for Panoche Drainage District. H.T. Harvey & Associates, Fresno, CA.
- U.S. Bureau of Reclamation. 2004a. San Luis Drainage Feature Re-Evaluation, Administrative Draft Environmental Impact Statement, Sacramento and Fresno, California.
- \_\_\_\_\_. 2004b. San Luis Drainage Feature Re-Evaluation, Plan Formulation Report Addendum, Sacramento and Fresno, California.
- \_\_\_\_\_. 2004c. San Luis Unit Long-Term Contract BA,
- \_\_\_\_\_. 2004d. Long-Term Central Valley Project and State Water Project Operations Criteria and Biological Assessment.

- \_\_\_\_\_. 1991. Draft Environmental Impact Statement, San Luis Unit Drainage Program, Central Valley Project, California, Sacramento, CA.
- U.S. Court of Appeals for the Ninth Circuit. 2001. Firebaugh Canal USA, Case Number 95-15300
- U.S. Department of the Interior. 2004. Land Retirement Demonstration Project, Year Four, 2002 Annual Report. Fresno, California.
- U.S. Fish and Wildlife Service. 2003. Planning Aid Memorandum on the San Luis Drainage Feature Re-Evaluation Plan. Memorandum to Regional Director, U.S. Bureau of Reclamation, Sacramento, California.
- U.S. Fish and Wildlife Service. 2004. Fish and Wildlife Service Comments and Recommendations on the San Luis Drainage Feature Re-Evaluation Plan. Memorandum to Regional Director, U.S. Bureau of Reclamation, Sacramento, California.
- U.S. Fish and Wildlife Service. 1995a. Compensation Habitat Protocol For Drainwater Evaporation Basins, January 1995. U.S. Fish and Wildlife Service, Sacramento, California. 26 pp.
- U.S. Fish and Wildlife Service. 1995b. Alternative Habitat Protocol For Drainwater Evaporation Basins, 1995. U.S. Fish and Wildlife Service, Sacramento, California. 11 pp.
- Westlands Water District Annual Water Reports. 1992-2000. Available at [www.westlandswater.org](http://www.westlandswater.org)
- Westlands Water District. 2002. Why land retirement makes sense for Westlands Water District. [www.westlandswater.org/long/200201/landretirebro.pdf](http://www.westlandswater.org/long/200201/landretirebro.pdf)

## PERSONAL COMMUNICATIONS

- Delamore, Michael. Bureau of Reclamation, Fresno, California
- Forrest, Kim. Manager, San Luis Refuge. Los Banos, California.
- Mcgahan, Joseph. Summers Engineering, Hanford, California.
- Philips, Scott. San Joaquin Basin Recovery Program, Fresno, California.
- Skorupa, Joseph. Biologist, USFWS, Arlington, Virginia
- Toto, Anthony. California Regional Water Quality Control Board, Fresno, California

